Aladdin Manual of Construction

THE ALADDIN CO.
Bay City-Michigan

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ALADDIN MANUAL OF CONSTRUCTION

THIRD EDITION

CONTAINING PRACTICAL METHODS COVERING EVERY STEP NECESSARY IN THE ERECTION OF ALADDIN HOUSES, BARNS, GARAGES, ETC.

PREPARED AND ILLUSTRATED BY
DAVID S. BETCONE

DEDICATED
TO OWNERS OF ALADDIN BUILDINGS

PUBLISHED BY
THE ALADDIN COMPANY
BAY CITY, MICHIGAN

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Foreword

IT is now nearly twelve years since the Aladdin Company started in the business of manufacturing and selling readi-cut houses. At that time little was known of the adventure and it has taken many years of hard work to build the successful and thriving business which this Company now maintains. One of the many things which has brought about this wonderful success is the service which our company gives to its customers, covering every step from the placing of the order to the completion of the home.

Many of the most important steps have been written in a serviceable form and published in this, our Aladdin Manual of Construction.

So remarkable was the success of the first editions of the Aladdin Manual of Construction that we kept at work enlarging its scope, perfecting its details and incorporating many additional and valuable features for this, the third edition. Exhaustive study was made of the thousands of records of home building which our customers have sent to us from every section of the country. Then facts were deducted from these vast experiences and reduced for your guidance, into the pages of this book, wherein you will find answered almost every question or situation that may arise in the work of building your home.

Notice

THE information contained in this booklet is very valuable and was compiled from practical experience and at great expense. This expense is justified if Aladdin customers will hand this booklet to the men in charge of the erection of their buildings so that they may acquaint themselves with the best and quickest methods of construction employed by the Aladdin System. Be sure and have the carpenters erecting the house, read all of Part III carefully as this information has direct bearing in the satisfactory completion of your home.

The Aladdin Company
Bay City, Michigan

General Introduction

THE purpose of this book, the third edition of the Aladdin Manual of Construction, is to help purchasers and builders of ALADDIN houses do away with the costly mistakes often made by contractors and home builders.

There is a popular demand for simple and practical methods for taking care of the different steps necessary in the erection of an ALADDIN building, outside of the general instructions and blueprints sent out to purchasers of the same.

In presenting this book to purchasers and builders of ALADDIN buildings, we will try to improve where we can, to make the erection of these buildings a success and a credit to all concerned, and will give practical methods of taking care of every step necessary in the erection of a modern dwelling house, and also estimates on some of these steps, which will help the builder and give a general idea of what the different steps should cost. But we wish it distinctly understood that these are average figures and will not apply to buildings in every part of the country, but will help to find out approximately what the different steps in the erection should cost and the best methods to use to obtain the results desired.

Today, the average man confronts many serious problems when he starts out to investigate the building of a home, and serious thought and study are necessary if he is to avoid costly mistakes. Taking into consideration beauty, strength, convenience and cost, it really takes an expert now-a-days to obtain the desired results. Our aim is to incorporate in this book and to give our customers the knowledge we have gained by years of actual experience in Home Building and Industrial housing projects, and it is our hope that the suggestions and methods contained herein, will steer the home builder clear of many pitfalls he might otherwise come to grief in.

The many gratifying letters we receive would seem to indicate that our methods of erection are fast becoming the standard of the home-building problem thruout the country. These methods have been perfected and will insure our customers better and quicker work at a much lower cost.

There may be some criticism as to some of the methods given, and the size of the book, understanding that volumes could be written on the subjects contained herein, and knowing that some prefer quantity to quality and would rather have a long drawn out subject which they could not understand easily, than a compact, easily understood article which will benefit them.

We understand "time is money" and we will make it a policy to handle each subject in as brief and simple a way as possible, to give a clear understanding in the most serviceable form.

Part 1 of this book is devoted to instructions and illustrations on the different steps necessary in the erection of ALADDIN houses not furnished in the GENERAL Instructions, such as excavating, foundation, chimney, etc.

Part 2 is devoted in detail to the making of lawns, flower gardens and the general beautifying of the surroundings of the building.

Part 3 is devoted to the General Instructions on the carpenter work, such as framework, exterior and interior finish, shingling, plastering, etc.

Part 4 is devoted to garages, barns and summer cottages.

Part 1.

Selecting the Location

THE most interesting subject in the average man or woman's mind is that of owning a home. There is a strong inducement in most everyone's nature which, sooner, or later, expresses itself in the desire to own a place called "Home." Many things should be taken into consideration when you are about to build one. One very important feature is the selection of the lot upon which your home is to be located.

Many people make a mistake in the start by selecting a lot not in the least desirable for the home they have decided to build, or vice versa. You should take into consideration the advantages and disadvantages of the location to make the home a place to cherish.

Do not be too hasty in selecting your lot. Decide first upon the approximate location which you consider the most desirable residential district; take into consideration the location of the schools for your children, the dirt or odors from the nearby factories and freedom from encroachment of business. Take into consideration the kinds of families, socially, that you would be willing to have associate with your children, the location of the churches, car service, and the people who patronize the same.

Neighborhood and locality should concern the home owner very much. Desirable real estate should gradually increase in value. If conditions exist in a neighborhood or locality that will tend to decrease value on real estate contained therein, the owner should be fully aware of the fact, and either avoid the neighborhood, or be reconciled for defects.

Do not buy a lot because it is cheap; a few hundred dollars more in the cost of your location is money well spent, as it will be one strong talking point should you ever wish to sell or rent.

This question of selling is seldom considered by most owners. The convertibility of the proposition into cash is a very important one. While there is usually no chance that there will be immediate desire to sell, the foresighted purchaser sees a possible pressing, and where advisable lets that thought guide him in his purchase. In short, the reasonable man does not disregard totally the realization that some day the material, time and labor expended may be desired to be converted into cash.

Give due consideration to improvements such as water, sewer, gas, and sidewalks. Be sure they are there, or satisfied that they will be when you are ready to build.

Keep away from lots near mills, factories, shops, saloons, stables, blacksmith shops, cemeteries, sanitariums, medical colleges, noisy streets, etc. These may not be objectionable to you, but will affect the sale should you ever desire to dispose of your property.

Of course in many building operations, there will be exceptions to the above, as in some new locations houses and property located near and convenient to factories, mines, etc., are much more in demand and more easily disposed of.

Home building can be put into two classes. One to secure income, and the other to secure comfort and convenience. The builder who is an investor, cares little about comfort and convenience of the property except that it returns him a greater income because he does not live there, and his every effort

is to conserve toward an increasing return of revenue. The owner, however, who is to build a home in which to reside, will, to his utmost extent, seek increasing comfort and convenience, and money will be sacrificed to bring them. Therein lies the discrimination to be sought and guided by, one to secure income, and the other to have comfort and convenience.

Be sure that the property you are interested in has a clear title. If you are not familiar with abstracts and conveyances, it is certainly money well spent to employ someone who is conversant with titles to look over the paper offered you for your money. Often property is encumbered by back taxes, and if they are not settled before purchase is made, you will be obliged to pay for same.

Title is something that, while not in the least intangible, it is to some people a little visionary, and is very liable to become disregarded. The buyer's protection is to require an abstract of title showing how the property stands on the records. If a person cares to go to the added expense, he may secure a warranted abstract of title. If, in the future, any question should arise, the concern issuing you the warranted abstract will adjust any defect at their own expense.

Contracts

IN order to build and obtain entire satisfaction and profit, and to prevent any holding up of payments, law-suits, or delays of any kind in the erection of the building, it is essential that the owner or builder should have written specifications with contractor or carpenter, which should settle the following questions:

(1.) What work is to be done?
(2.) What material is to be used? (ALADDIN in your case.)
(3.) How is it to be done?
(4.) When is it to be completed?
(5.) What is it to cost?
(6.) The manner of payment?

General Conditions

The contracts and specifications signed between the party of the first part (as the owner) and the party of the second part (as the contractor) should not contain conditions which involve any unnecessary trouble or expense to the contractor or builder.

The best results will be obtained by the party of the first part, if said contract will read so as to modify all conditions in order that a feeling of co-operation to obtain the desired results will exist between the two parties. The result desired should always be visible in the wording of the contract: the means of obtaining the result should be left to the contractor.

Except in a few cases, we would not advise the owner to let a "General Contract," that is, a contract to one man to do all the work necessary to complete an ALADDIN house.

Invariably, we have found that the owner will have better success by

letting the contract for the erection of the frame and all necessary carpenter work of an ALADDIN house to a couple of good, handy men, or hire them to work by the day. Of course, contracts for foundation, plumbing, excavating, footing, etc., should be given to men who make this line of work a specialty. How to make contracts for the work mentioned above, will be dealt with later. It is always wise to ask the carpenter to show you a house he has built, and to talk with the owner of it.

While a contractor is under obligations, after taking the contract, to carry out the work to the best of his ability, as worded in the contract, it is well to remember that the acceptance of the contract was a purely voluntary act on his part, and that he was under no obligation to take it.

What Is To Be Done

It is his right to know before he puts in his bid, just what he is expected to furnish and to do, and not to be left to furnish what in the mind of some party not interested in him, are materials of "good quality" or work of "best quality." Nothing will bring better results from him than to have a feeling of co-operation. As to the kinds of material to be used, it is always better to specify the best. Do not take a chance with inferior grades. They will not last and will have to be replaced in a short time. You should always specify just what kind of material you want furnished, as contractor when making estimate, might figure on one kind while you will expect another.

In the erection of ALADDIN HOUSES, the general instructions for erection contained in Part III of this manual will state just how work is to be done and what material the contractor will have to work with.

If there are any changes to be made in plans, it is best to make them on the blueprints and to have a distinct written understanding with contractor before he starts work. This will do away with the "extra" charges which you will have to pay after the job is completed, and which you have not been figuring on.

Payment

The payments of the contracts, while so arranged as to protect the party of the first part from over-payment, should also be worded in such a manner as to require a certain amount of the capital on the part of the contractor, which will make it possible for him, if his capital is limited, to take care of all his bills and pay his labor promptly. This co-operation is mainly for the interest of the owner, as he will find himself able to get a better class of workmen to figure on his work, than when said contracts seem to point to a domineering spirit.

In letting contracts, the owner will find that it is not always the best plan to give his work to the contractor who hands in the lowest bid. It is seldom that satisfactory results can be obtained from a man who is losing money; generally he so manages by furnishing inferior material and workmanship, that the owner is the loser.

When It Is To Be Completed

Although it is a good plan to specify when you wish your work completed, which will do away with the contractor neglecting your job in order to

hold some other one, allowances should always be made for bad weather, shortage of materials, etc.

The following are examples for different contracts:

Form of Agreement Between Owner and Carpenter

Bay City, Mich., Feb. 1, 1918.

An agreement entered into this 1st day of February, 1918, between_____, of Bay City, Mich., as owner and party of the first part, and_____, also of Bay City, Mich., as builder and party of the second part.

The said party of the second part, for and in consideration of the sum of Three Hundred Seventy-five Dollars and Fifty Cents ($375.50) in payment, to amount to the valuation of the work satisfactorily completed and in place at date of payment, agrees to construct the ALADDIN dwelling house, Style_____, at_____, for the said party of the first part, in accordance with drawings and instructions.

_____(Owner)

_____(Builder)

In presence of:

_____

_____

Example of Contract Covering Excavating, Foundation, Cement Floor and Chimney.

Bay City, Mich., Feb. 2, 1918.

An agreement entered into this 2nd day of February, 1918, by and between_____, of Bay City, Mich., owner and party of the first part, and_____, also of Bay City, Mich., contractor and party of the second part.

The said party of the second part, for and in consideration of the sum of Four Hundred Twenty-eight Dollars ($428.00) in payments to amount to the valuation of the work satisfactorily completed and in place at date of payment agrees to excavate, erect foundation and chimney and lay cement floor according to the following instructions.

Excavation

Contractor to excavate, as shown to be necessary by drawings, for basement, grade cellar entrance, etc., depth of excavation to be so as to bring top of foundation 3 ft. 0 in. above sidewalk level. (Grade line to be 1 ft. 0 in. above sidewalk level.) The black dirt is to be kept separated from clay so that it can be utilized in grading lawn, and after masonry is thoroughly set and dry, "back fill" in around foundation so that carpenter will not be inconvenienced while working around building.

Footings

All footings are to start on solid soil and to be size shown on blueprints. Drain tile is to be laid around entire building, and connected with sewer, drain tile to be embedded in crushed stone; connections to be made with drain tile to run up to grade to take care of drop outlets in eave trough as indicated on blueprints. Footings to be made of concrete of a mixture of one part Portland cement, two parts sharp sand and five parts crushed stone, or if made of coarse gravel, to be one part cement and seven parts gravel.

Walls

Walls are to be constructed as shown on blueprints together with all girder and porch piers. Walls to be constructed of Zagelmeyer System Dry

Tamp 8x24 in. blocks. Seven courses to be laid below grade, with water table and two courses above. Walls below grade to be plastered on outside with cement plaster containing sufficient water proofing to insure wall impervious to water. The joints of blocks above grade to be neatly pointed off. Openings to be left in walls for windows as shown on blueprints. Frames to be set in walls while under construction and bedded in solid. Walls to be protected from elements by contractor while under construction.

Cement Floor

Cement floor in basement to be grouted with 3 in. of broken stone, sand and Portland cement, finished with ½ in. fine Portland cement mortar mixed in proportion of half and half, grouting to be left rough so that finishing will adhere to same readily.

Chimney

Fire place chimney to be constructed with two flues, one for fire place and other for furnace. (Detail of fire place shown on blueprint.) Flue, fire place and ash pit to be constructed as shown on blueprints, all to be built of good hard, sound, burned, common brick laid in lime mortar.

Where chimney is shown above roof, face same with selected, cherry red, sand mold brick of even color and neatly point and clean down on completion.

Top six courses to be laid in cement mortar. If flue lining is not to be used, all flues should be well plastered on inside. Bricks are to be wet if laid in warm weather and must be dry if laid in damp or freezing weather. All joints are to be flushed solid, chimney to have galvanized iron flashing let into brick work around roof and to be counter flashed into shingles of roof.

Fire place to have cast iron damper and firebrick lining. Brick for facing fire place to be selected by owner.

Mortar

All brick mortar to be made of best lime (1 part), clean sharp sand (2 parts). Cement mortar to be composed of Portland cement (1 part), clean sharp sand (2 parts). Too much water must not be used in mixing, and only mortar as is required for immediate use should be mixed at one time. None that has stood over night will be satisfactory.

----------(Owner)
----------(Contractor)

In presence of:

Form of Furnace Contract

Bay City, Mich., Oct. 13, 1915.

Furnace Contract to H. W. Murdy for Special Style House now being constructed at Bay City, Mich.

An agreement entered into this 13th day of October, 1915, by and between H. W. Murdy, of Bay City, Mich., party of the first part, and Anthony Burns, also of Bay City, Mich., contractor, and party of the second part.

The said party of the second part, for and in consideration of the sum of One Hundred Dollars ($100.00) net on completion of the job, agrees to furnish and install 1-A No. 130 "Sovereign" Steel Radiator Warm Air Furnace according to the following instructions.

Connect furnace and chimney with galvanized pipe, L-8 inch cold air pipe connecting with wood cold air face located in dining room. To run 12 inch warm air pipe connecting same with two way box and two registers between kitchen and dining room.

To run a warm air pipe (12 inch) connecting to a two way box between living room and front chamber, two registers.

To run a 10 inch warm air pipe connecting with a two way box between center and back chambers, two registers.

To run an 8 inch warm air pipe to a single box, floor or base board connection in bath room.

To cover all warm air pipes with asbestos.

Living room and dining room register to be brass finish, other registers to be B. J. base board.

Completed job guaranteed to properly heat the above house to be completed as per blueprints, in zero weather without excessive firing.

_____(Owner)

_____(Contractor)

In the presence of:

_____

_____

* * * * * * *

Other contracts should be drawn up in a similar manner and there always should be a distinct understanding between both parties as to just what is to be done and the price to be paid.

Laying Out Building Lines

THE first step is to determine exactly where you wish your building to be located upon the ground. This is generally governed by the surrounding property. Try as much as possible to line up your building with those adjoining you. It will increase the value of your property and also of that next to you. Nothing looks more unsightly than to have one house close to the public walk and the next one set back away from it. Always take into consideration side porches, driveways, and sidewalks. Keep your building as far away from other buildings as possible, as this will reduce danger of fire, give you a lower insurance rate and more privacy.

When you are absolutely sure of the position of your building, you are ready to stake out for your excavating.

First, we find a starting point. This starting point should be the center of the front wall. For example, refer to Fig. 1.

We wish the building to be placed 25 feet from the walk line. Measure back 25 feet from the walk and place a stake as shown by letter A. Now your building is, say 28x30 feet. Place a stake 14 feet on each side of letter A as shown by letters B, and C. These stakes will also be 25 feet from the walk line. Then place a line parallel to B and C 30 feet back from these points. Now from one of the measured points, B and C, draw a tape to as nearly square from the

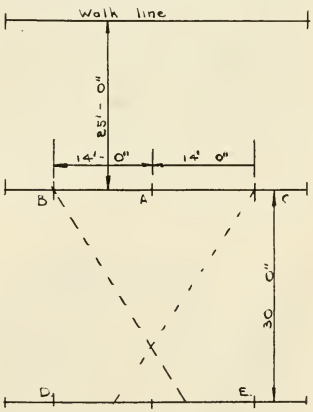


Fig. 1 shows method of staking out building.

center point A as can be guessed at, and place a stake there. Then measure the same distance from the other measured point B and place in another stake. Divide the distance between these two stakes and you will have squared across from the center point A. Then measure 14 feet on each side of the center and your stakes will be 28x30 feet as shown by letters B, C, D, and E.

Another method which is often used is the 6, 8, and 10 rule, which can be used to square the excavation without the use of other stakes and lines. It is very simple and can be done very quickly by three persons, placing them at points A, B, and C. See Fig. 2. This distance between A and B on the staking lines should be 8 feet, then from A to C, 6 feet. Then place a tape from B to C. The tapes will form a rectangle with sides measuring 6, 8 and 10 feet. This method can also be employed to square up many other parts of the building such as joists, walls, partition, etc.

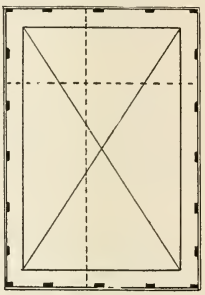


Fig. 3—Plan of lines, stakes on batter boards.

Angles measuring 12-16 and 20 feet for the side and hypotenuse can be used, the larger the angle the more accurate your result.

Another method which is more convenient and accurate is that of erecting batter boards around the site of the building. This is a rough fence erected by driving stakes into the ground about 3 or 4 feet outside the walls of the building or far enough away so that it will not interfere with working around building. They should also be placed high enough so that when lines are placed from one to the other, they will come above top of foundation walls.

By referring to Fig. 3, you will notice that points can be indicated on these batter boards for outside of foundation walls, center line of girder piers (mark center line of pier) and outside porch piers. Nails are to be driven in at these points indicated on batter boards and then chalk lines can be stretched in place. From the chalk line plumb lines can be dropped to indicate points at the bottom of your excavation, giving very accurate location. It is much easier to put up batter boards with a transit and level, but they can also be erected by using the method illustrated in Fig. 2.

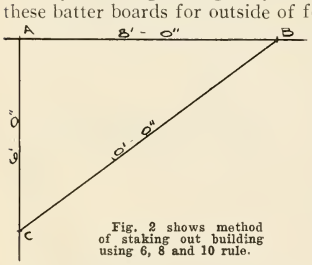


Fig. 2 shows method of staking out building using 6, 8 and 10 rule.

Different markings can be used on the batter boards to indicate location; for example—a nail will represent outside of foundation — a notch, center line of pier,

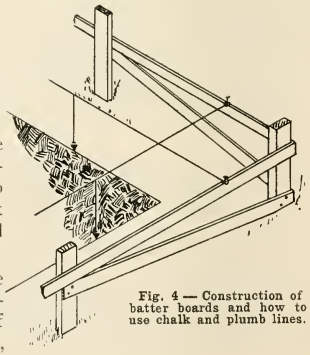


Fig. 4 — Construction of batter boards and how to use chalk and plumb lines.

and a "saw curf" center line of chimney footings, etc. In this way the workmen are not liable to make any mistakes.

On the upright stakes of the batter boards, nails can be placed to indicate top of finished grade, water table and top of walls and piers. The batter boards can be left in place and used until after the joists have been laid and then removed so as not to interfere with material and men moving around the building.

Excavating

AS this work is largely a matter of judgment based on actual experience in this line, a teaming contractor is generally better posted as to the condition of the soil and the circumstances under which he has to work, that is, if material has to be hauled from building site, if the soil is clay or sand, etc. He also knows about what to expect from a man and a team under these different conditions on different classes of work. He generally is in a position to quote prices on the excavating by the yard or for the job complete. It is always best to have an agreement with the excavating contractor as to where and how the dirt is to be placed, that is, if your lot is covered with rich black dirt which you wish to use for grading your lawn, he should understand that this dirt is to be laid aside and not covered up with clay or sand which is generally found in the bottom of excavations.

In the absence of full instructions, it is best to figure to excavate a foot outside of all walls or footings to give ample working room for laying brick, cement blocks, putting in cribbing, etc.

The cost of excavating will depend upon the nature of the soil, and placing of excavated material.

We will not devote much space to this subject, but will give the method of getting cubic contents of cellar, the average price per cubic yard and a day's work in this locality.

To get the number of cubic yards contained in a cellar, multiply the floor space by the depth of the cellar from the grade down; divide the result by 27 (there being 27 cubic feet in one cubic yard). The result will be the number of cubic yards.

For example: Building 20x30 feet and we wish to excavate 4 feet below grade.

20x30 is equal to 600.

4x600 is equal to 2400.

2,400 divided by 27 is equal to 88.8 cubic yards.

Allowance, of course, will have to be made for dirt excavated in order to give working room around walls.

The following is the average day's work from one team and two men in this locality; figuring $4 a day for team and $3 a day for each man, making $10 in all.

Sand—50 yards per day at $10 equals 20c per cubic yard.

Sand and clay—40 yards per day at $10 equals 25c per yard.

Hard clay—20 to 30 yards per day at $10 equals 33c to 50c per yard.

These prices have been given for cellars that are not to be over 6 feet in depth, where a plow can be used. If the cellar is very deep, you will have to allow for carting material out of cellar, which would be considered an extra.

In inspecting the excavation, the builder should first examine the lines to see that the building has been correctly staked out and that the excavation has been carried at least one foot outside of the wall lines so as to give room for pointing or cement plastering on the outside of the walls.

If the walls are built against a bank, it will be impossible to point the joints on the outside, and the back of the wall not being exposed, the masons are apt to slight this part of the work to the future detriment of the building when complete, ready to be sold or occupied.

Again, if the excavation is not made large at first, it causes much trouble, as the work cannot be done as cheaply afterwards, and the masons will very likely complain about being delayed.

When quicksand or water is encountered in making the excavation, provision for taking care of the same will be dealt with under the subject of footings.

Tips on the Cost of Excavating

On a 25 ft. haul, one man with a team and drag scraper will make a round trip in 1½ minutes, and will excavate 50 cu. yds. of earth in 10 hours.

On a 50 ft. haul, it will require 2 minutes for a trip, and one man and team will excavate 45 cu. yds.

On a 100 ft. haul, it will require 2½ minutes per trip, and one man and team will excavate 40 cu. yds.

On a 200 ft. haul it will require 3½ minutes per trip, and one man and team will excavate 35 cu. yds. in 10 hours.

A man with team and plow will loosen about 400 cu. yds. of earth in 10 hours.

One man with a pick will loosen about 4 cu. yds. of earth per hour.

In excavating you will find the following methods most economical for the distances given: Drag scrapers, up to 200 ft.; wheelbarrows, from 200 to 300 ft.; wheel scrapers, 300 to 600 ft.; one-horse carts, 600 to 800 ft.; two-horse dump-wagons, 800 to 1,000 ft. and up.

The capacities of different carriers used in excavating are as follows: Drag scrapers, 4 to 7 cu. ft.; wheelbarrows, 3 to 4 cu. ft.; wheel scrapers, 10 to 16 cu. ft.; one-horse carts, 14 to 20 cu. ft.; two-horse dump-wagons, 27 to 36 cu. ft.

The average team will walk from three to four miles per hour.

The cost of team hauling is about 26 cents per mile of haul.

One man will spread or level 75 cu. yds. of loose earth in one 10 hour day.

A man with team, scraper and helper will spread or level 50 cu. yds. of loose earth per hour.

One man will shovel into wheelbarrows or carts, about 2 cu. yds. of loose material per hour.

Excavating in trenches not over 6 ft. in depth can be estimated at 1 cu. yd. per hour per man. Where the depth is over 6 ft. but under 10, you can figure ½ cu. yd. per man per hour, and where the depth is greater than 10 ft. but less than 14, you can figure 1/3 yd. per man per hour. These figures do not include piling.

TABLE I

The Following Table Gives the Number of Cu. Yds. of Excavation in Cellar. From 12x16 up to 40x50 and 3, 4, 5 and 6 Ft., Floor Grade.

First 3 Ft. Excavation.

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
12	21.33	24	26.66	29.33	32.	24.66	37.33	40.	42.66	45.33	48	50.66	53.33	56.	58.66	61.33	64.	66.66
14	24.88	28	31.11	34.22	37.33	40.44	43.55	46.66	49.77	52.88	56	59.11	62.22	65.33	68.44	71.55	74.66	77.77
16	28.44	32	35.55	39.11	42.66	46.22	49.77	53.33	56.88	60.44	64	67.55	71.11	74.66	78.22	81.77	85.33	88.88
18	32.	36	40.	44.	48.	52.	56.	60.	64.	68.	72	76.	80.	84.	88.	92.	96.	100.
20	35.55	40	44.44	48.88	53.33	57.77	62.22	66.66	71.11	75.55	80	84.44	88.88	93.33	97.77	102.22	106.66	111.11
22	39.11	44	48.88	53.77	58.66	63.55	68.44	73.33	78.22	83.11	88	92.88	97.77	102.66	107.55	112.44	117.33	122.22
24	42.66	48	53.33	58.66	64.	69.33	74.66	80.	85.33	90.66	96	101.33	106.66	112.	117.33	122.66	128.	133.33
26	46.22	52	57.77	63.55	69.33	75.11	80.88	86.66	92.44	98.22	104	109.77	115.55	121.33	127.11	132.88	138.66	144.44
28	49.77	56	62.22	68.44	74.66	80.88	87.11	93.33	99.55	105.77	112	118.22	124.44	130.66	136.88	143.11	149.32	155.55
30	53.33	60	66.66	73.33	80.	86.66	93.33	100.	106.66	113.33	120	126.66	133.33	140.	146.66	153.33	160.	166.66
32	56.88	64	71.11	78.22	85.33	92.44	99.55	106.66	113.77	120.88	128	135.11	142.22	149.33	156.44	163.55	170.66	177.77
34	60.44	68	75.55	83.11	90.66	98.22	105.77	113.33	120.88	128.44	136	143.55	151.11	158.66	166.22	173.77	181.33	188.88
36	64.	72	80.	88.	96.	104.	112.	120.	128.	136.	144	152.	160.	168.	176.	184.	192.	200.
38	67.55	76	84.44	92.88	100.10	109.77	118.22	126.66	135.11	143.55	152	160.44	168.88	177.33	185.77	194.22	202.66	211.11
40	71.11	80	88.88	97.77	106.66	115.55	124.44	133.33	142.22	151.11	160	168.88	177.77	186.66	195.55	204.44	213.33	222.22

(SECOND) 4 Ft. Excavation

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
12	28.44	32.	35.55	39.11	42.66	46.22	49.77	53.33	56.88	60.44	64.	67.55	71.11	74.65	78.22	81.77	85.33	88.88
14	33.18	37.33	41.44	45.61	49.77	53.92	58.07	62.22	66.37	70.51	74.66	78.81	82.96	87.11	91.25	95.40	99.55	103.70
16	37.92	42.66	47.41	52.14	56.88	61.63	66.37	71.11	75.85	80.59	85.33	90.07	94.81	99.55	104.29	109.03	113.77	118.51
18	43.55	48.	53.33	58.66	64.	69.33	74.66	80.	85.33	90.66	96.	101.33	106.66	112.	117.33	122.66	128.	133.33
20	47.41	53.33	59.26	65.18	71.11	77.03	82.96	88.88	94.81	100.74	106.66	112.59	118.51	124.44	130.37	136.29	142.22	148.14
22	52.14	58.66	65.18	71.70	78.22	84.74	91.25	97.77	104.29	110.81	117.33	123.85	130.37	136.88	143.40	149.92	156.44	162.96
24	56.88	64.	71.11	78.22	85.33	92.44	99.55	106.66	113.77	120.88	128.	135.11	142.22	149.33	156.44	163.55	170.66	177.77
26	61.63	69.33	77.03	84.74	92.44	100.14	107.85	115.50	123.25	130.96	138.66	146.37	154.07	161.77	169.48	177.18	184.88	192.59
28	66.37	74.66	82.96	91.25	99.55	107.85	116.14	124.44	132.74	141.03	149.33	157.63	165.92	174.22	182.51	190.81	199.11	207.40
30	71.11	80.	88.88	97.77	106.66	115.50	124.44	133.33	142.22	151.11	160.	168.88	177.77	186.66	195.55	204.44	213.33	222.22
32	75.85	85.33	94.81	104.29	113.77	123.25	132.74	142.22	151.70	161.18	170.66	180.14	189.63	191.11	208.59	218.07	227.55	237.03
34	80.59	90.66	100.74	110.81	120.88	130.96	141.03	151.11	161.18	171.25	181.33	191.40	201.48	211.55	221.63	231.70	241.77	251.85
36	85.33	96.	106.66	117.33	128.	138.66	149.33	160.	170.66	181.33	192.	202.66	213.33	224.00	234.66	245.33	256.	266.66
38	90.07	101.33	112.59	123.85	135.11	146.37	157.63	168.88	180.14	191.40	202.66	213.92	225.18	236.51	247.70	267.85	270.22	281.48
40	94.81	106.66	118.51	130.37	142.22	154.07	165.92	177.77	189.63	201.48	213.33	225.18	237.03	248.88	260.74	272.59	284.44	296.29

(Third) 5 Ft. Excavation

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
12	35.55	40.	44.44	48.88	53.33	57.77	62.22	66.66	71.11	75.55	80.	82.96	88.88	93.33	97.77	102.22	106.66	111.11
14	41.48	46.66	51.85	57.03	62.22	67.40	72.59	77.77	82.96	88.14	93.33	98.51	103.70	108.88	114.07	119.25	124.44	129.63
16	47.40	53.33	59.25	65.18	71.11	77.03	82.96	88.88	94.81	100.74	106.66	112.59	118.51	124.44	130.37	136.29	142.22	148.14
18	53.33	60.	66.66	73.33	80.	86.66	93.33	100.	106.66	113.33	120.	126.66	133.33	140.	146.66	153.33	160.	166.66
20	59.25	66.66	74.07	81.48	88.88	96.29	103.70	111.11	118.51	125.92	133.33	140.74	148.14	155.55	162.96	170.37	177.77	185.18
22	65.18	73.33	81.48	89.63	97.77	105.92	114.07	122.22	130.37	138.51	146.66	154.81	162.96	171.11	179.25	187.40	195.55	203.70
24	71.11	80.	88.88	97.77	106.66	115.55	124.44	133.33	142.22	151.11	160.	168.88	177.77	186.66	195.55	204.44	213.33	222.22
26	77.03	86.66	96.29	105.92	115.55	125.18	134.81	144.44	154.07	163.70	173.33	182.96	192.59	202.22	211.85	221.48	231.11	240.74
28	82.96	93.33	103.70	114.07	124.44	134.81	145.18	155.55	165.92	176.29	186.66	197.03	207.40	217.77	228.14	238.51	248.88	259.25
30	88.88	100.	111.11	122.22	133.33	144.44	155.55	166.66	177.77	188.88	200.	211.11	222.22	233.33	244.44	255.55	266.66	277.77
32	94.81	106.66	118.51	130.37	142.22	154.07	165.92	177.77	189.63	201.48	213.33	225.18	237.03	248.88	260.74	272.59	284.44	296.29
34	100.74	113.33	125.92	138.51	151.11	163.70	176.29	188.88	201.48	214.07	226.66	239.25	251.85	264.44	277.03	289.63	302.22	314.81
36	106.66	120.	133.33	146.66	160.	173.33	186.66	200.	213.33	226.66	240.	253.33	266.66	280.	293.33	306.66	320.	333.33
38	112.59	126.66	140.74	154.81	168.88	182.96	197.03	211.11	225.18	239.25	253.33	267.40	281.48	295.55	309.63	323.70	337.77	351.85
40	118.51	133.33	148.14	162.96	177.77	192.59	207.40	222.22	237.03	251.85	266.66	281.48	296.29	311.11	325.92	340.74	355.55	370.37

(FOURTH) 6 Ft. Excavation

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
12	42.66	48.	53.32	58.66	64.	69.32	74.66	80.	85.32	90.66	96.	101.32	106.66	112.	117.32	122.66	128.	133.32
14	49.76	56.	62.22	68.44	74.66	80.88	87.10	93.32	99.54	105.76	112.	118.22	124.44	130.66	136.88	143.10	149.32	155.54
16	56.88	64.	71.10	78.22	85.32	92.44	99.54	106.66	113.76	120.82	128.	135.02	142.22	149.32	156.44	163.54	170.66	177.76
18	64.	72.	80.	88.	96.	104.	112.	120.	128.	136.	144.	152.	160.	168.	176.	184.	192.	200.
20	71.10	80.	88.88	97.76	106.66	115.54	124.44	133.32	142.22	151.10	160.	168.88	177.76	186.66	195.54	204.44	213.32	222.22
22	78.22	88.	97.76	107.54	117.32	127.10	136.88	146.66	156.44	166.22	176.	185.76	195.54	205.32	215.10	224.88	234.66	244.44
24	85.32	96.	106.66	117.32	128.	138.66	148.22	160.	170.66	181.32	192.	200.20	213.32	224.	234.66	245.32	256.	266.66
26	92.42	104.	115.54	127.10	138.66	150.22	161.76	173.32	184.88	196.44	208.	219.54	221.10	242.66	254.22	265.76	277.32	288.88
28	99.52	112.	124.44	136.88	149.32	161.76	174.22	186.66	199.10	211.54	224.	236.44	248.88	261.32	273.76	286.22	298.66	311.10
30	106.62	120.	133.32	146.66	160.	173.32	186.66	200.	213.32	226.66	240.	253.32	266.66	280.	293.32	306.66	320.	333.32
32	113.72	128.	142.22	156.44	170.66	184.88	199.10	213.32	227.54	241.76	256.	270.22	284.44	298.66	312.88	327.10	341.32	355.54
34	120.82	136.	151.10	166.22	181.32	196.44	211.54	226.66	241.76	256.88	272.	287.10	302.22	317.32	332.44	347.54	362.66	377.76
36	128.	144.	160.	176.	192.	208.	224.	240.	256.	272.	288.	304.	320.	336.	352.	368.	384.	400.
38	135.02	152.	168.88	185.76	200.20	219.54	236.44	253.32	270.22	287.10	304.	320.88	337.76	354.66	371.54	388.44	405.32	422.22
40	142.22	160.	177.76	195.54	213.32	221.10	248.88	266.66	284.44	302.22	320.	337.76	355.54	373.32	391.10	408.88	426.66	444.44

Footings

THE footings of all buildings are determined by the size of the foundation and the bearing power of the soil. We will give a practical method of how they are to be constructed and the cost of the same.

In larger buildings, it is necessary to study the soil under the footings and determine its bearing power, but in ordinary frame buildings, this is not necessary unless specified by the building laws of the state. Still you can find a large number of concrete, cement block or brick foundation walls which have cracked and settled down, this being caused by the poor method used in putting in the footing.

The writer has often had arguments with contractors about the size of footings. When a certain size is specified, they will say, "Now, I always use a 16x4 inch footing."

They have formed a habit of using a certain size footing regardless of the size of building and the bearing power of the soil. Now, this footing might be all right in some cases, but they certainly should take into consideration the size and weight of the building and the nature of the soil upon which the building is to rest in order to furnish a foundation which will not crack and settle to the future detriment of the operation.

The method we will use will be given assuming that the soil under the footing is composed of sand, sand and clay, or hard clay.

In our buildings, it will sometimes be found that the width of the footings will be less than that required by the building ordinances, in which case it will be necessary to comply with such ordinances or building laws.

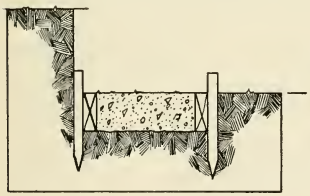


Fig. 5 shows method of placing 2x6's in trench to form footings.

As a rule, the footings under a foundation wall should be at least 8 or 10 inches more than the thickness of the wall, to give it stability and always proportioned according to the size of the wall in order to give it the same pressure per square foot on the ground. That is, for an 8 inch wall, the footings should be from 16 to 18 inches, for 10 inch wall, from 18 to 20 inches, etc.

For house construction, using as an example 8 inch hollow concrete block walls, the footings require 2x6's staked around the bottom of the cellar so as to make the footings below the bottom of excavation. Fig. 5 shows method of placing 2x6's in trench for footings. Then if cement floors are to be used the underside of the same will be on a level with the top of the footings, and it will not be necessary to fill in again for the cellar floor.

These forms made of 2x6's are to be put in level, then the concrete put in place. Two good carpenters will put down these forms for 50 lineal feet of footing in an hour, which makes the cost (55c per hour in this locality) approximately 2¼c per foot. The lumber used for the forms has not been figured in, as same can be used again after the concrete in the footings has set.

The concrete mixed, placed in forms and tamped level, costs per cubic yard as follows for mixture one part cement, two parts sand and five parts crushed stone. The prices used are quotations of Jan. 1st, 1918, at Bay City, Mich.

5 Sacks of Cement at $2.40 Barrel	$3.00
1/3 Yard Sand at $2.00 Yard	.67
5/6 Yard Crushed Stone at $3.00 Yard	2.50
6 Hours Labor at 30c per Hour	1.80
Total	$7.97

Then if one yard costs $7.97, one cubic foot would cost $7.97 divided by 27, or about 29½c.

The concrete mixed in the following proportions of one part sand and seven parts coarse gravel.

5 Sacks Cement at $2.40 per Barrel	$3.00
1¼ Yards Coarse Gravel at $2.50 a Yard	3.13
6 Hours Labor at 30c per Hour	1.80
Total, per Cubic Yard	$7.93

Example: To find the cubic feet in 125 lineal feet of footing 16 inches wide by 6 inches thick.

16 inches equals 1 1/3 feet.
6 inches equals ½ foot.
(1 1/3 x ½ equals 2-3 cubic feet) x 125 equals 250/3, or about 83 cubic feet.

83x29½ equals	$24.48
Labor on Forms	2.81
Total	$27.29

cost of 125 lineal feet footing 16 inches wide, 6 inches deep, or about 22c per lineal foot. Of course, this price will vary according to the cost of material and labor.

Drainage of Footings

Under all footings for dwelling houses, draintile should be placed, unless the soil is very sandy, so it will carry off the water. These tiles are placed so as to carry off the water which will run down the side of the foundation wall. The tile conducts the water to the sewer and prevents it from washing in under the footings and weakening them. It also helps to keep the cellar dry and free from moisture and water.

The tile generally used is about 3 inches in diameter. The draintile should be connected with the sewer pipes in order to drain the water from around the foundation walls and connections made from the down spouts of the eaves.

The draintile should be laid on the outside of the footing and the top should come below the cellar floor. Over the top of the draintile, crushed stone should be placed so as to allow the water to wash into the joints and also keep them from clogging with mud. In case crushed stone cannot be obtained to cover tile, a good grade of cinders can be substituted with good results. See section of foundation walls which shows location of tile.

The draintile will cost 3½c per lineal foot.

If the building is to be erected where no sewer is available, the draintile can be connected with a "Septic Sewage Disposal" or into a drain barrel set far enough from the building to prevent back flow. See construction of "Septic Sewage Disposal."

Footings over Quicksand

When putting in the footings, if quicksand is encountered, piles can be driven down until you strike clay or solid earth. Cedar posts can be used for this purpose, thus avoiding the unnecessary expense of excavating down to clay or rock. In places where only small stretches of quicksand are encountered, the footings can be reinforced by inserting steel rods or steel wire to bind the part over the quicksand with that which comes over solid ground.

However, it is not very often necessary, in ordinary house construction, to go to any precautions of this nature except in places where very poor, loamy or made-soil is encountered when excavating.

Inspecting Footings

As stated before, too much care cannot be bestowed upon the footings and foundation. The mortar, cement and lime want to be fresh, and sand of a good, clean, sharp grade. Be careful to see that the footings are well tied together. If the walls which are to be erected upon the footings are to be of poured concrete, plenty of three-quarter rough stones should project above the top of the footings so as to bind the walls and footings together. Be very careful to see that no dirt or loam is left upon the footings before the walls are constructed. If there is, it will work out and form a crevice through which water will work into the cellar. An old broom can be used to clean the footings if it is found necessary. It is also a good plan to wet them thoroughly, as this will help the concrete or cement mortar from the upper wall to adhere to them. Also see that proper footings are placed under fire place chimneys, girder piers, etc.

Footings under chimney should be much larger in comparison than foundation wall footings, as the height of chimney, places a more direct load at this particular point.

Concrete

CONCRETE, practically speaking, is a manufactured stone, the active element of it is cement which is mixed with the aggregate consisting of sand, stone, gravel, clay, cinders, etc.

Concrete has increased in value and usefulness every year until today it is the most valuable of building materials being used to advantage in most every form of building construction.

The durability of concrete depends largely on its density and hardness. Round particles properly graded from the finest to the largest size permitted, give a denser mixture than angular shaped.

Gravel, crushed rock, cinders or shale are used according to the availability of the materials and character of the work. Granite and trap rock are the most desirable crushed stone, as they make a harder and denser concrete. The size of the particles varies with the kind of work. The larger they are, (within the limits) the stronger the concrete. For ordinary work, which is over six inches thick, they can run up to three inches in diameter. The diameter of the largest one should never equal half the thickness of the piece of work under construction. On some work, the specifications state that the stone should not exceed 1½ inches in diameter.

Another very important thing to consider is the sand. Sand should not contain impurities. Where there is much fine material, the sand should be washed. If compelled to use sand containing a high percentage of fine grains, first mix the dry materials very thoroughly, add water and avoid too much troweling; otherwise it will in time develop "hair cracks" on the surface. These are seldom more than 1/16 of an inch deep and will not weaken the concrete to any great extent, but are unsightly and should be avoided. Do not use sand that can be pulverized between your fingers, nor sand that soils the hands, or that smells, indicating decayed organic matter. A good way to test sand is to stir it in a glass of water: good sand settles at the bottom, leaving the water clear.

Cost of Washing Sand

If the sand isn't clean it is always advisable to wash it before using. A very simple way is to build a loose board platform 10 to 15 ft. long with one end 12 in. lower than the other end. On the lower end of this platform and on the sides, nail a 2x6 on edge to keep the sand on the platform. Spread the sand out in a layer 3 or 4 in. deep and then wash by applying water from the garden hose or pail. The washing should be started at the high end and the water allowed to run through the sand and over the 2x6 piece at the bottom. A small quantity of clay or loam will not injure the sand to any great extent, for general purposes, but any amount over 5% should be washed out.

The strength of the concrete is always limited by the strength of the sand and if fine or dirty sand in quantities is used, only a part of the full value of the cement can possibly be developed.

On large operations, much time and money can be saved and better re-

sults accomplished by studying the proper proportions of the ingredients obtained in that locality for the most economical, yet densest concrete; as density means strength, impermeability, and durability. If all the materials are of a good quality, the mixture will not have to be made as rich as if the materials were of an inferior grade.

Knowing what ratio of sand and stone will make the most dense mixture, the proportion of cement to be used can easily be determined. For example, if 2½ parts of sand will fill all the voids in 5 parts of stone, their ratio 2½:5 would make the most dense possible mixture of these two ingredients, that is, no more sand or stone could be added to this mixture without increasing its bulk. If we want to add 1 part of cement to 7½ parts of sand and gravel, we will have the proportion of 1-2½-5 meaning 1 part cement, 2½ parts sand and 5 parts stone.

It is also very important that the cement be of a very good quality. Do not think that you are going to save money by buying a cheap cement. It will be a detriment to the operation later on. The writer has always received good results from Alpha Portland and Atlas Portland cements.

The following table gives practical suggestions for proportioning concrete for general purposes.

Table II

Material Required per Cubic Yard to Concrete Cubic Yard

Prop. by Volumes	Bbl. Cement	Sand Cu. Yd.	Stone Cu. Yd.
1 : 2 : 3	1.57	0.52	0.78
1 : 2 : 4	1.33	0.44	0.88
1 : 2 : 5	1.15	0.38	0.95
1 : 2 : 6	1.00	0.33	1.00
1 : 3 : 4	1.07	0.53	0.70
1 : 3 : 5	0.96	0.48	0.80
1 : 3 : 6	0.89	0.44	0.88

The following mixture to be used where the ground may be moist and extreme weight must be carried.

1 Part Portland cement.
2 Parts clean, sharp sand.
3 Parts broken stone (not over two inches in size).

The following combination will give you a concrete strong enough to carry the tallest building.

1 Part Portland cement.
2 Parts clean, sharp sand.
4 Parts broken stone.

The Following mixture will be found to be strong enough for most all ordinary construction.

1 Part Portland cement.
3 Parts clean, sharp sand.
6 Parts broken stone.

Note on Handling Concrete

Average load broken stone or gravel for wheelbarrow....2.4 cu. ft.
Average load sand for wheelbarrow.....2.5 cu. ft.
Large load of broken stone for iron wheelbarrow on hard land .....3.0 cu. ft.
Large load of sand in iron wheelbarrow.....3.5 cu. ft.
Average load of ordinary concrete for iron wheelbarrow..1.9 cu. ft.
Large load of ordinary concrete for iron wheelbarrow....2.2 cu. ft.
Number shovelsful of concrete per barrow, average load.....13
Number shovelsful of concrete per barrow, large load.....15
Average quantity of concrete tamped in forms by gang of 10 men, per day of 10 hours .....22 cu. yds.

Data on the Cost of Handling Sand or Gravel

The cost of loading sand or gravel onto cars is approximately 20 cents per cu. yd.

The cost of shoveling sand direct from car to storage bins is generally from 6 to 10 cents per cu. yd.

One man will usually load from 15 to 20 cu. yds. of sand onto wagons in 10 hours.

The cost of hauling sand by team is about 26 cents per mile.

A cu. yd. of sand, gravel or crushed stone is a fair load for a team.

A man and team using ordinary dump board wagon, will load and haul on an average of 5 loads of sand a distance of 1¼ miles from pit to storage in 9 hours.

The cost of loading sand, stone or gravel into wheelbarrows is approximately 12 cents per cu. yd.

The cost of washing sand or gravel is about 20 cents per cu. yd. when work is done by hand.

Mixing Concrete

On most small jobs, the concrete is mixed by hand unless a mixing machine can be obtained easily.

A batch of concrete is the term applied to a mixture containing so many bags of cement, the cement denoting the basic unit. Thus, a two-bag batch contains two bags of cement, plus the sand and stone in correct proportions. The following shows the quantities of materials required for a two-bag batch of different proportions, and the resulting amounts of concrete. Four bags of cement equal a barrel, and a barrel contains 3.8 cubic feet:

For a 1-4 mixture that will make 9 cubic feet of concrete use two bags of cement, 3.8 cubic feet of sand, 7.6 cubic feet of stone.

For a 1-2½-5 mixture that will make 10.9 cubic feet of concrete, use two bags of cement, 4.8 cubic feet of sand, 9.6 cubic feet of stone.

For a 1-3-6 mixture that will make 12.8 cubic feet of concrete, use two bags of cement, 5.8 cubic feet of sand and 11.6 cubic feet of stone.

In mixing concrete by hand, the mixing board is equally as important as the measuring box. Concrete should not be mixed on the ground. It is never permitted on professional building operations. It is wasteful of both materials and labor and fails to produce good work. Dirt is almost certain to enter the mixture, the cement grout runs off and is lost in the ground, and the work of shoveling and turning the mixture is made unnecessarily difficult.

The mixing board is a simple wooden platform, made fairly water-tight by the use of matched lumber. Inch roofers will do nicely and, being surfaced, they will reduce friction in shoveling and turning. If any old sheet iron or tin is available, it is a good plan to cover platform with same. Fasten the boards together with four or five cleats, using two-by-three or two-by-four stuff, and see that no nailheads project to interfere with shoveling. Side boards extending about six inches above the platform will help to keep the concrete materials under control. The boards should be blocked up level to keep the cement grout from running off to one side, and supported in the center to keep the weight from breaking it. For two-bags batches a platform ten feet square is ample.

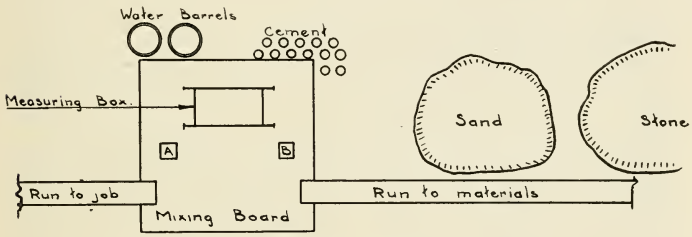


Fig. 6 shows convenient layout for mixing platform material.

Refer to Fig. 6 which shows a correct lay-out of mixing platform and materials.

In selecting a site for the mixing platform choose, a place as close to the work as possible, also one that is convenient to the piles of sand and stone. Better select a site for the platform first, and then have the concrete materials dumped alongside.

The next step is to provide wheelbarrow runs for carrying the ingredients to the platform, and for conveying the concrete from the platform to the job. These runs should consist of rough boards or planks 12 inches wide. When layed on the ground, boards an inch thick will do. If elevated above ground or made to span openings, two-inch planks are necessary. Runs twelve inches wide will do for the ground work, but on inclines or elevated positions, they should be not less than twenty inches wide, preferably twenty-four inches.

Narrow runs are dangerous; they make the laborers timid, consequently too much time is lost in being careful.

It is a mistake to assume that any old thing in the way of boards will answer for runs. The wheelbarrows will slip from poor runs or be overthrown, or else go bumping along over the irregular surfaces in a precarious gait. Experienced builders find that it is economy to build smooth, substantial runs. They lighten and quicken the work to a remarkable extent.

Assuming that the forms for the concrete are completed, that the materials and implements are all on the site and everything is in readiness, the next step is the actual process of mixing. System is required for this work above everything else if the different operations are to be maneuvered with any degree of facility. Clumsy methods are the greatest time killers. Avoid operations in which the laborers are constantly getting in one another's way, and having the materials so near the platform that they interfere with freedom of action. In short, see to it that there is plenty of elbow-room.

One man should be assigned to the sand, another to the stone, and a third to the cement and water. All three combine when it is time for mixing and turning. First load the sand in a wheelbarrow and dump it into the measuring-box, which is placed on the mixing board about two feet from one side.

When the sand box is filled level, loosely, without packing it down, remove it, and with the aid of a rake, spread the sand about half the area of the platform in a layer three or four inches deep.

Next empty two bags of cement on top of the sand, and in so doing, aim to distribute the cement as uniformly as possible.

With two men—one on each side of the pile—mixing the sand and cement in a dry state, each laborer will turn over the half of the mass on his side. Never use water at this stage of the work. To do so makes it impossible to distribute thoroughly the cement throughout the mass.

In turning over the mixture, do not simply dump each shovelful in a heap —rather broadcast it with twisting motion which aids greatly in mixing the materials. The pile should be turned over completely at least twice, or until the sand and cement are thoroughly mixed, which will be indicated by a uniform color. The last time they are turned the pile should be in the center of the platform and leveled with the rake to receive the crushed stone or larger aggregate.

Place the measuring box on top of the leveled mass, fill it with stone level with the edges of the box, remove the box, level the stone pile with a few strokes of the rake, replace the box and fill it once more, for it should be remembered that twice as much stone is required as sand, and the measuring box is dimensioned for the latter.

Some operators use two measuring boxes, one twice the size of the other, but this is not necessary. Again, the ingredients are sometimes measured by using a wheelbarrow, first determining the capacity of the barrow, and then using this capacity as a unit of measurement. It takes a practical eye to fill the barrow uniformly, consequently this method is not nearly so accurate as the measuring box.

When the stone is added to the pile, it is time for the water. Pour it on top of the stone, and while one man is doing so the other laborers turn mass from one side of the platform to the other, working about the same as

with the sand and cement mixture. Add water to the dry spots, as this turning proceeds until the mixture is of the desired consistency. Dash the water on with buckets filled from barrels, not with a hose, though a hose is convenient for filling the water barrels. Water can be measured in pailfuls, whereas there is no way of estimating the supply from a hose.

It is possible to prescribe a definite quantity of water for a given batch for each job, for the reason that the sand and stone are both likely to contain varying percentages of moisture to start with. From ten to twelve gallons is about the average quantity for a two-bag batch, 1-2-4 mixture. The point about measuring the water is this: Once a batch has been mixed to the desired consistency and the number of pailfuls of water is counted, a process that must be approached with more or less caution, all subsequent batches can be given the same number of pailfuls without further concern.

Competent laborers should have the concrete thoroughly mixed in three turnings, whereupon it is ready to be placed in the forms, and no time should be lost in getting it there, or the concrete will take on its initial set and it is then worthless.

Do not heap or pile concrete; this would let the coarse particles roll to the outer side of the pile.

Do not mix too much concrete ahead, or more at a time than can be handled readily, and be sure not to use too quaky a mixture.

The water should be at a temperature of about 65 or 70 degrees, and be clean and free from alkalis or oil. Cold water below 40 degrees retards the setting of concrete. The amount of water to use varies according to conditions. Concrete can be divided into three groups, "Wet," "Medium," and "Dry."

"Wet" concrete requires but little tamping in the forms and pours readily into corners and crevices. It is used mostly in reinforced work, as the metal can be easily embedded. It will require a bucket or similar vessel for hauling.

For general use, a "Medium" mixture gives the most dense and strongest concrete. It quakes like jelly and can be carried on shovels.

"Dry" concrete should contain just enough water so that when tamped, it will come to the surface. The dryer and hotter the weather, the more water should be added.

As soon as the concrete is mixed, it should be wheeled to the forms and deposited in layers of not over 6 inches and well tamped. Do not allow the concrete to dry too rapidly, as it will not reach its maximum strength unless kept damp until it has set properly. If the concrete is allowed to dry too rapidly, it is liable to crack from contraction, and when exposed to the weather, will be affected by the elements. After the concrete has set, it is best to keep it wet for about seven days, as this will aid in strengthening it.

How to Measure Sand, Gravel, Etc.

A barrel averages 3.8 cubic feet. Therefore, for a mixture of one to seven, that is, one barrel of cement to seven parts of sand and gravel or stone, there would be 3.8 cubic feet of cement to 26.6 cubic feet of sand and gravel.

A frame or bottomless box as shown by Fig. 7 is the best way to measure. A box 5 feet long, 3 feet, 6 inches wide and 18 inches deep will contain about 26.6 cubic feet, and can be used for a 1 to 7 mixture.

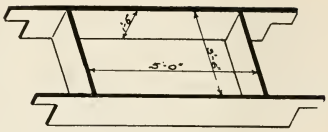


Fig. 7—Box used in measuring sand, gravel, etc.

Mark off the side of the box, seven spaces if you are going to use that proportion of sand and gravel to one part of cement. If 6 parts of sand and stone to 1 part cement, mark off 6 spaces. If you want two parts sand, fill up to top of second space. If five parts stone, fill up to top of fifth space, etc.

Place the frame upon the mixing board or platform and fill with the material to be used. Then lift out of place, leaving the material on the platform.

Atmospheric Influences and Laying Concrete in Freezing Weather

The setting time of cement is hastened by heat and retarded by cold. Cement that has been stored in a close, unventilated building has been known to become quickly set on extremely hot days. It is always advisable to provide ventilation and shelter from the sun, excessive heat and dampness. Keep the cement in a dry, moderate atmosphere. The walls and floors of storage shed should be lined with paper, so the cement will not take up moisture from the air or ground. In hot weather concrete should be mixed with more water than in cold weather and kept wet for about the first seven days; this will add to the density and strength of the mass.

A good general rule is to avoid laying concrete when the temperature is below freezing, unless it is absolutely necessary. But mass concrete, when made of Portland cement, can be laid in almost any temperature, providing the proper precautions are taken to keep the frost off until it has set properly. There are a number of different opinions regarding the injury of concrete from freezing and thawing. Some say that it will not be affected; but as there are a number of examples of concrete construction which show serious injury from freezing, it seems advisable to lay it when the temperature is above freezing.

Concrete can be protected in freezing weather by adding common salt or chloride of lime to the water which will lower the freezing point. The amount of salt or chloride of lime should not exceed 10 per cent. of the weight of the water. A good rule is to add 1 per cent. of salt for each degree below 32 degrees F.

Hot water can be used for mixing and the sand and stone can be heated before mixing.

Cold does not affect concrete already set, but will freeze the water in green cement and prevent setting till the frost has been thawed out. Then the same reaction occurs as though water had been added and the mass will set properly unless frozen a second time. It should not be allowed to repeatedly freeze and thaw.

Time for Removing Forms

No exact time schedule for removing forms is wise in concrete work, for

the consistency of the mixed batch and the climatic conditions must necessarily govern this to a great extent.

The nature of stresses in the member to be relieved of support, must also be given consideration. As an example of individual practice the following from a large firm of contractors is given:

Walls and mass work, one to three days, or until the concrete will bear the pressure of the thumb without indentation.

Thin walls in summer, two days; in cold weather, five days.

Slabs up to 6 ft. span, in summer, six days; in cold weather, two weeks.

Beams, girders and long span slab, in summer, ten days or two weeks; in cold weather, three weeks or one month. If shores are left undisturbed, the sheeting can be removed in the summer time after one week.

Column forms, two days in summer; in cold weather four days, providing girders are shored to prevent appreciable weight reaching columns.

Conduits, two or three days, provided there is no heavy fill upon them.

Arches of small size, one week; large arches with heavy dead load, one month.

We want it understood that these suggestions are general and must be followed with good judgment. The method of removing forms must necessarily vary according to the character of the structure. The forms will ordinarily come away from the concrete with a moderate amount of sledge and barwork. We would by all means recommend that a competent man be put in charge when the forms are removed.

Water Proofing Concrete

When mixing concrete, no little consideration should be given to the water in the soil. If the soil is wet and generally saturated with moisture, the water is very apt to rise in the walls. Many different methods are used to prevent this with varying results.

Like all other building stone, concrete contains many voids through which a small quantity of water seeps. Water proofing is done by either external or internal methods. In both methods the concrete should be very dense in consistency, and rich in cement. When it is impossible to pour continuously as on monolithic construction, roughen the surface of the old cement before resuming and then apply a neat cement or rich mortar. This should make a watertight joint.

Internal water proofing is accomplished by the following methods:

(1.) By proportioning the aggregate to the greatest possible density.

(2.) By adding a mixture of soap and alum; for a mortar of 1 part of cement to 3 parts of sand, add 1 part of alum to every cubic foot of sand and from ½ to ¾ pound of soft soap to every gallon of water.

(3.) By adding patent water proofing compounds.

(4.) Some Portland cements are claimed to be water proof.

(5.) By replacing part of the cement with a small portion of well slacked lime—not more than 10 per cent. of the weight of the cement. This not only increases the water tightness of the cement but also adds to the strength.

External water proofing is applied to the water exposed surface after the concrete is in place. Various methods are used, such as:

(1.) Plastering, troweling, or a gravolithic finish. A plaster of neat cement applied to the surface with a brush.

(2.) Two or three coats of hot asphalt applied with a brush after the walls have set and dried out. Common coal tar is often used, but as it becomes hard and brittle, and gradually breaks away from the walls, it is not considered to be very good.

(3.) Oil or paraffin washes; layers of paper or felt applied either to the surface or between successive layers of concrete.

(4.) Liquid compounds applied like paint. Some of these act like paint or glaze, others are absorbed by the concrete, filling the pores. Some are claimed by the maker to act chemically on the cement.

Colored Concrete

In using concrete for decorative purposes it is frequently desirable to have the finish surface colored. The average contractor is, as a rule, not thoroughly familiar with the processes by which the various tints may be obtained. The coloring effects are obtained by adding certain coloring matter to the cement and sand before the water is added. Great care, however, should be exercised in the promiscuous use of coloring materials in order to obtain the desired colors and also to guard against the addition of injurious substances. Cement Age gives the following methods for obtaining various colors, these recommendations being based upon the experience of a noted American authority. Statement is made that the quantities given are per barrel of cement, the coloring matter in each instance being mixed dry with the cement and sand. Caution is given that Venetian red and common lampblack should not be used, as the color obtained with these materials will run and fade. The various colors and quantities of coloring material per barrel of cement are as follows:

For brown, 25 lbs. of best roasted iron oxide; or 15 to 20 lbs. of brown ochre.

For black, 45 lbs. of manganese dioxide.

For blue, 19 lbs. of ultramarine.

For buff, 15 lbs. of ochre. (This is likely to considerably reduce the strength of the mixture.)

For green, 23 lbs. of greenish blue ultramarine.

For gray, 2 lbs. of boneblack.

For red, 22 lbs. of raw iron oxide.

For bright red, 22 lbs. of Pompeiian or bright English red.

For violet, 22 lbs. of violet iron oxide.

For purple, 20 lbs. of Prince's Metallic.

The objection is sometimes made to the use of mortar colors in that they are not as strong as white mortar or concrete and that the color always fades.

These objections, no doubt, have some truth in them, when a cheap grade of color is used. But at the present time, a good grade of color can be obtained, which will not affect the strength of the mortar and cement, and the colors hold fast for a considerable length of time.

Foundations

General Conditions

TOO much attention cannot be given to the construction of the foundation for your building, and many things have to be taken into consideration in order to get good results. As mentioned in the previous chapter under footings, it is essential that you study the character of the soil and be sure that proper footings are put in place first. The sizes of footings and piers given on blue prints furnished with an ALADDIN house have sufficient strength to support the buildings for which they have been designed, under ordinary conditions, that is, providing the soil has a fair amount of bearing power. They have also been designed to meet the requirements in most parts of the country, but in some states, the building codes specify the sizes of walls and footings, and in such cases, they will have to be complied with in order to pass inspection.

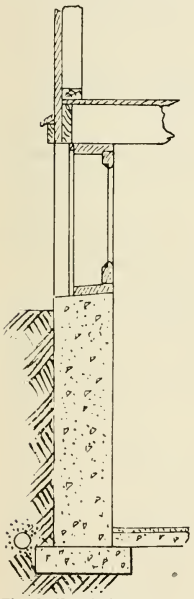


Fig. 8—Foundation of poured concrete.

No little consideration is to be given to the amount of water in the soil. If the soil is wet, the water is apt to rise in the walls. If this condition is found, the walls should be water proofed (refer to waterproofing of concrete). All foundations should be handled in the same manner.

The bottom of the foundation should be carried well below the local frost line, as frost acts upon the soil and would crack the walls if they did not have bearing on solid ground not affected by frost.

Consideration should be given to the depth of the sewer, so as to insure good drainage to the cellar. Many cellars have been constructed in such a manner that a great deal of trouble is encountered by the backing up of the sewage which is a great menace to sanitation and to the health of the occupants.

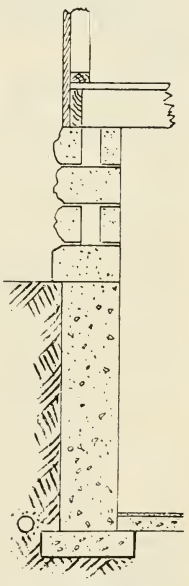


Fig. 9 — Foundation of poured concrete and cement blocks or stone.

There are a number of different types of foundation walls which are practical and which are now accepted in general use. Illustrations of the construction of the ones most often used are shown on the pages following. They are:

First: The entire foundation of poured concrete. (Refer to Fig. 8.) This shows a 10 inch wall of poured concrete placed upon an 18 inch footing. It also shows the manner in which the cellar frame is placed in the wall.

Second: Part of foundation wall of poured concrete (that is, from footing up to grade) with cement blocks or dressed stone from grade up to top of wall. (See Fig. 9.)

Third: Entire foundation wall constructed of cement blocks. (See Fig. 14.)

Fourth: A concrete wall of monolithic construction. (See Figs. 18, 19, 20.)

Fifth: Wall of cobbler stone. (See Fig. 21.)

Sixth: Ashlar wall, main part of wall, brick or stone, with veneer of stone. (See Figs. 22, 23, 24, 25.)

Seventh: Foundation wall of brick construction. (See Fig. 41.)

Eighth: Construction of wall for brick veneer. (See Fig. 42.)

Building Forms for Concrete Walls

THE forms which are used for poured concrete walls are a very important step to insure a good foundation wall. They must be well squared up, tied together and braced so that they will not spread or sag when the concrete is being tamped into them.

As a rule they are built by carpenters, and like any other construction, all carpenters don't understand it. They often use too much material, and sometimes not enough. The way to build forms is to use the simplest possible method with the least material that will guarantee the job.

Of course, concrete in its pouring stage has quite an outward pressure, and it requires that no weak spots are left in the forms to burst out.

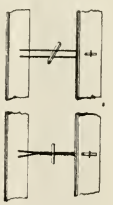


Fig. 10—Method of tying forms together.

Plumb lines dropped from the lines or wires placed on batter boards will enable you to keep forms well plumbed up and square during erection.

Matched lumber, if it can be obtained, is the best to use for forms, as this will prevent the water from carrying off any of the strength out thru the cracks which would be between the boards if the forms were constructed of ordinary sheathing. Do not place the 2x4's which hold the forms in place, too far apart, as this will cause the boards in between to give away to some extent and make an uneven wall. If good sheathing is used for forms, they should be placed about 18 or 20 inches apart.

Tie the 2x4's together with good strong fence wire. If you wish a 10 inch wall, cut a lot of small pieces of wood about 1x2 inches and 10 inches long and place them in between the sheathing of the inside and outside forms (these are called spreaders), drawing the forms tightly together by the use of the form ties or pieces of wire placed around the 2x4's of the forms and

drawn together by twisting them in the center. (See Fig. 10.) The small pieces of wood should be removed with a rake as the concrete is poured into the forms.

Many times it is possible to use the bank around the excavation as one form, not starting the outside form until you have poured up to grade. This can be done when the soil is of hard clay and there is no danger of it caving in while you are working around it. (See Fig. 11.) In wet climates, we would not advise using this method unless a good water proofing can be obtained and mixed in with the concrete. Little is saved in this manner as it is much more difficult to work around the walls.

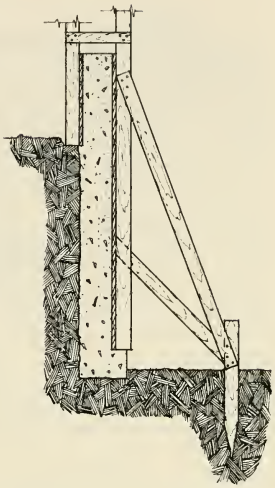


Fig. 11—Construction of form when built against bank.

After erecting the forms for the foundation as shown by Fig. 12, measure up from the footings the height you wish the wall to be, and nail around on the inside of the sheathing of the outside forms, small pieces of wood in the shape of a right angle about an inch on each side. These pieces will want to be leveled up around the building, the top of which will be the top of the wall. (See letter A of Fig. 12.) These pieces will cut the corner of the wall on the outside and will also act as a drip when the water table has been nailed in place.

Under ordinary conditions, the forms can be removed from the wall in from 36 to 48 hours after the wall is completed, or just as soon as the top of the walls cannot be dented by poking a stick into them. But no great weight should be placed on walls until after they have been exposed to the air three or four days.

Be very careful to see that your forms are well squared up and securely blocked before pouring, as weak forms are bound to be forced out of place when cement is put in place.

If window and door frames are to be placed in wall, sub-forms will have to be used to make openings or the frames nailed in place between the two walls of the form. This is the best plan if you can secure the frames in time as they can be imbedded into the green cement securely.

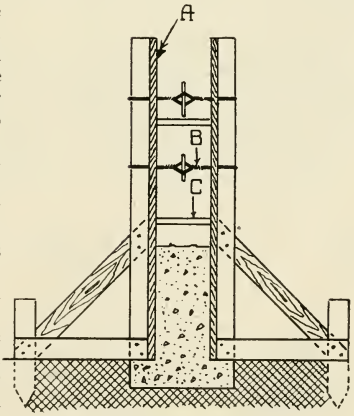


Fig. 12—Cross section of concrete form.

Concrete Foundations

EXCEPT in few localities, where native stone is to be had very cheaply, practically all walls are now being constructed of concrete. Experience has taught for strength, warmth and enduring qualities, foundations and basement work constructed of this material is far superior to brick and wood piles, and for economy and ease in construction, it has an advantage over stone.

This growing popularity for foundations and basement work for frame houses, makes it very desirable for all builders to become familiar with the many ways in which it can be used to advantage.

It is not necessary for a builder to employ the services of a concrete specialist to show him how his foundation or basement work is to be put in. This work can be done by good, handy men or by the builder himself.

It is impossible for us to advise any particular kind of construction, as materials differ in price according to the localities in which they are to be used. We will, however, give the approximate cost and how to construct the different kinds of foundation walls previously mentioned.

First: The entire wall constructed of poured cement: You will note by referring to Fig. 8, that this shows a 10 inch wall 7 feet high constructed upon an 18x6 footing. For example, we will take a foundation 20 feet wide, 30 feet deep, 7 feet high and 10 inches thick, erected upon 18x6 footing.

If the soil is firm as it should be, no forms will be needed for the footing, the concrete being poured into a trench dug around the building 6 inches below the level of the cellar bottom. Let this footing become thoroughly set before starting to put up your forms for walls. This will make the cost of the footings about 22c per lineal foot, not including forms. (See footings.)

The cost of the lumber in forms for the erection of a foundation of this kind will not be included in the estimate as this material can be used again, and oftentimes a foundation contractor will have forms which he can use.

In a foundation 20x30, there would be 100 lineal feet footings 18x6 which would contain 75 cubic feet of concrete.

Cost of labor and materials on 75 cu. feet of footing at 29½c:

75x29½c	$22.13
564 Cu. feet of concrete in walls at 29½	166.38
Total	$188.51

This does not allow for window openings.

The window frames should be fastened in the forms and the concrete poured around them. It is a good plan to drive a few spikes on the sides of the frames and let them extend into the concrete. This will hold frame firmly in place or if frame cannot be secured when foundation is being erected a subform can be used and wood lugs placed in concrete to nail frame to afterward. (See Fig. 13.)

The cost of the wall can be greatly reduced by filling in the center with old brick or tile, which will not weaken it to any extent. Do not use pieces too large. They should not exceed ½ the thickness of the wall. The outside of this wall above the grade line, can be plastered over with cement plaster and pointed off to represent blocks, or will look well if stuccoed from grade up.

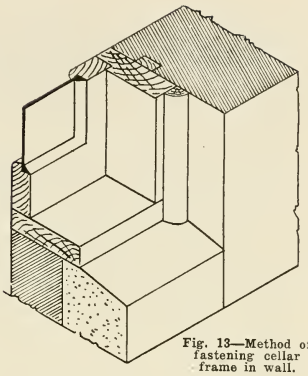


Fig. 13—Method of fastening cellar frame in wall.

If you do not intend to cover the outside of the wall with cement plaster or stucco, gravel should be used instead of stone, from the grade up, in order to give the wall a good appearance. In this case, the outside of the wall can be rubbed down with a rough fire brick before it has set hard in order to take out any defects made by cracks or knots in the lumber used for the forms.

Block Foundations

EXPERIENCE has proven that concrete blocks, when properly made, can be sold and laid up in a wall much cheaper than bricks of similar grade. While concrete blocks or artificial stones have been manufactured for many years, it is only recently that the use of concrete building blocks has rapidly developed.

There is an increasing demand for concrete or cement blocks for various uses in the building trades, but they are used with the best results at the present time, for foundations. Concrete blocks are generally manufactured in factories which have been equipped with forms and machinery for making and thoroughly curing them before they are brought to the building site. In using concrete blocks, the main portion of the expense in connection with plain concrete walls built in place, that is, the construction of the forms and the handling of the concrete, is avoided.

Another great advantage in concrete block walls is the use of forms, which results in hollow walls, that is, blocks with one or more hollow spaces, or blocks so constructed that their combination in a wall produces hollow spaces in it. These act as a dead air space, and also make the wall more impervious to moisture and act as an insulation against heat and cold and saves material.

We stated before, that the blocks were generally made in factories, but sometimes it is possible for builders to obtain machinery and forms and make their own blocks. Therefore, we will devote a little space to how they are constructed and the materials required.

The size of the contents is generally small, the gravel or stone not exceeding ¼ inch to ½ inch in size. At least 1/3 of the whole mixture should

be coarser than ⅛ inch, and a block made of such gravel and mixed in the proportion of one part of concrete to five parts of sand and gravel will give much better results than a mixture of one to three of sand only. These coarse fragments will not show on the surface of the block when the material has been properly mixed, and they also add to the density and strength of the blocks.

Sand and gravel are generally the cheapest materials for concrete blocks. Stone screenings, when of good quality and not too large, will make as strong a concrete as sand and gravel and will make the block lighter in color.

Dryslacked lime or Hydrate lime added to the mixture of concrete for blocks in the proportion of about one-fourth of the amount of cement used, gives the blocks a much lighter color and also makes them much denser and they will be less liable to be soaked with water.

Alpha Portland cement is the best and cheapest cement which can be used for cement blocks and is the only kind used to any great extent. It is strong and will reach its maximum strength whether used in air or water. The proportion of water is an important matter and affects greatly the quality of the work. The water should flush to the top of the block when tamped and should be a "quaky" mixture.

Some manufacturers of blocks make them with too dry a mixture so that the forms can be removed at once. If this material used does not have enough water the ingredients will not adhere and the block is very porous.

Some blocks are faced with fine crushed granite of different colors and are used on foundations from the wall up and gives a more stone like appearance to the wall.

Proportion of Material for Concrete Building Blocks

IN the proportion of materials used for concrete blocks, the most important considerations are strength, appearance and cost.

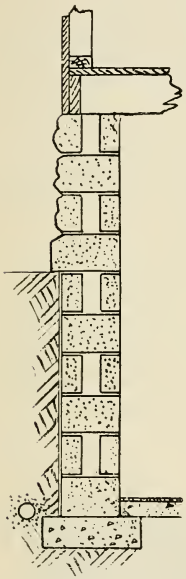


Fig. 14—Concrete block foundation.

It is not impossible to make blocks of a mixture of about 1 to 8 or 1 to 10 and have them strong enough to put into a wall, but you will find that they are extremely porous and will not stand the elements of the weather and the rough handling that they may have until laid in the wall. The strength of the block depends altogether upon the kind and proportion of the material used.

Experience has taught that good blocks cannot be made of any poorer proportion than 1 to 5. Even in a mixture of this kind, it is necessary to use a small amount of Hydrate lime and have the best quality of properly graded sand and gravel and a good deal of water and tamping in order to make them non-porous.

Mixtures for concrete blocks should be wet as possible. Do not allow the blocks to dry too fast; they should be protected during the ageing (curing and hardening) period from sun and excessive temperature. For the first few days of ageing, it is well to sprinkle daily. An atmosphere of steam hastens the process.

Do not use the blocks until properly aged. This precaution is often ignored.

Cement and sand veneer should be sufficiently moist, not too richly proportioned, nor contain too fine sand, and should be kept well moistened while ageing.

The term "gravel" means a good mixture of sand and stone screenings up to ½ inch in size. Good blocks cannot be made with fine sand alone, without using a good deal of cement, which makes the cost of the block too expensive.

Fig. 15—ALADDIN Hand Batch Mixer.

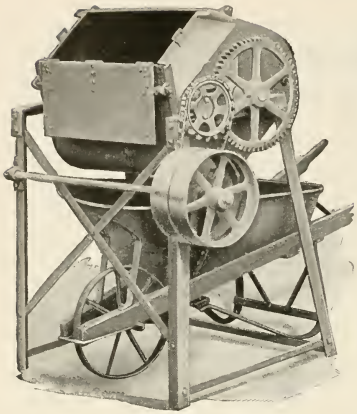


Fig. 16—ALADDIN Power Batch Mixer.

The following mixtures have been used with the best success, for concrete blocks. (Proportion of from 1 and 1 to 1 and 3 are used for facing of the blocks.)

1 to 4 mixture by weight.
Cement 150, Gravel 600.
Cement 125, Hydrate Lime 25, Gravel 600.

1 to 5 mixture by weight.
Cement 120, Gravel 600.
Cement 100, Hydrate Lime 20, Gravel 600.

1 to 4 mixture by cubic measure.
1 Barrel Cement (3.8 cubic feet) Gravel 15.2 cu. ft.
3 sacks Cement (2.85 cu. ft.) 1 bu. Hydrate Lime, (15.2 cu. ft. Gravel).

1 to 5 mixture cubic measure.
1 Barrel Cement (3.8 cu. ft.), 19 cu. ft. Gravel.
3 Sacks Cement (2.85 cu. ft.), 1 Bushel Hydrate Lime, 19 cu. ft. Gravel.

When concrete blocks are used for foundations, they are usually started upon footings of wet concrete of the proper width and thickness for the size of the wall. The blocks are usually made 24 inches long, 8 inches high and 8, 10 and 12 inches thick, according to the size of the building and building codes of the different parts of the country.

The blocks should be laid up in courses so that one joint will not come over another. The outside of the wall from footing up to grade, can be made absolutely waterproof by plastering with cement plaster which contains water proofing, or can be given a coat of hot asphalt.

The material required for laying the blocks must be of a good grade and mixture, about one to four or one to five mixture for this purpose. Using a one to four mixture, the proportion of material will be 1 yard sand to 1-2/3 barrel of cement.

The following material will be required to lay one thousand 24 inch and 16 inch blocks, figuring that the joints will be about 3/8 inch thick.

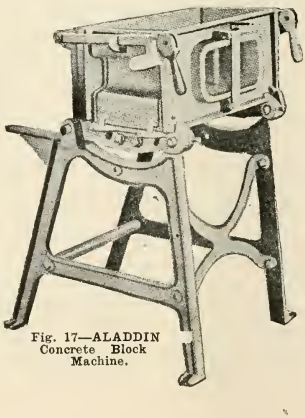


Fig. 17—ALADDIN Concrete Block Machine.

Cost of 100 Blocks Made with 1: 2: 4 Mix.

Size of Block Inches	Gravel		Sand		Cement		Labor Making	Total Cost
	Amt. Yds.	Cost	Amt. Yds.	Cost	Amt. Bbls.	Cost		
8x 8x16	1.05	$2.10	0.79	$1.58	2.02	$4.84	$3.44	$11.96
8x10x16	1.40	2.80	1.06	2.12	2.62	6.28	3.75	14.95
8x12x16	1.68	3.36	1.27	2.54	3.08	7.39	4.06	17.35
8x 8x24	1.62	3.24	1.23	2.46	3.12	7.48	5.00	18.18
8x10x24	2.02	4.04	1.53	3.06	3.80	9.12	5.31	21.35
8x12x24	2.43	4.86	1.82	3.64	4.46	10.70	5.63	23.83

Above blocks are made with a mixture of 1 part cement to 3 parts sand, and 4 parts gravel and are faced with ½-inch facing, of 1 part cement to 2 parts sand.

Cement is figured at $2.40 Bbl.
Sand is figured at $2.00 per yard.
Gravel is figured at $2.00 per yard.
Labor is figured at $2.50 per 10 hour day.

Cost of 100 Blocks Made with a 1 to 5 Mix.

Size of Block Inches	Sand		Cement		Labor Making	Total Cost
	Amt. Yds.	Cost	Amt. Bbls.	Cost		
8x 8x16	2.03	$4.06	2.75	$6.60	$2.00	$12.66
8x10x16	2.73	5.46	3.68	8.83	2.68	16.97
8x12x16	3.26	6.52	4.40	10.56	3.20	20.28
8x 8x24	3.13	6.26	4.23	10.15	3.08	19.49
8x10x24	3.74	7.48	5.06	12.14	3.68	23.30
8x12x24	4.14	8.28	5.60	13.44	4.48	26.20

Sand used is bank run, well graded.
Cement figured at $2.40 per bbl. net.
Sand figured at $2.00 per yd.
Labor figured at $2.50 per 10 hour day.

TABLE IV

Table showing number of cement blocks required in building from 16x16 up to 50x60

Wall 10 blocks high. Block sides 8x8x24"

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
16	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760
18	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780
20	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800
22	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820
24	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840
26	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860
28	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880
30	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900
32	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920
34	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940
36	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960
38	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980
40	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000
42	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020
44	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040
46	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040	1060
48	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040	1060	1080
50	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1000	1020	1040	1060	1080	1100

Special designs are made for water table, corners, porch and girder piers. When ordering or making blocks for your foundation, you will have to figure out number of plain, which are to be used below grade, number for water table, number for girder piers, porch piers and corners. Table IV gives number of blocks in foundation of 16x16 up to 50x60 in size for the walls alone. No pier blocks have been figured in. The number of plain, water table and smooth or rock face will have to be governed by the height of walls and grade.

Foundation of Monolithic Construction:

FOUNDATIONS constructed in this manner as shown by Figs. 18, 19 and 20 are economical and are not alone confined to a saving of concrete, but of material and construction of the forms as well.

This monolithic construction, or walls constructed of hollow piers and curtain walls, is most successfully used when it is necessary to construct a wall only from grade up.

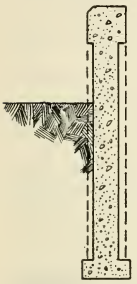


Fig. 20 — Shows section of monolithic wall.

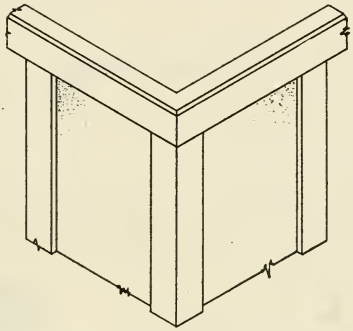


Fig. 19—Perspective of corner monolithic wall.

Fig. 18 — View showing connection of pier and curtain walls, monolithic construction.

Providing the ground in the trenches is solid enough, no forms will be needed for the footings. If the piers are constructed of blocks instead of poured concrete, which is often done, forms will be needed for the curtain walls only.

The piers should be constructed with grooved sides so as to allow the curtain walls to set into them. The forms for the walls and also the piers, if they are constructed of poured cement, can be built in sections and used over and over again, without any re-sawing or wasting of lumber. Where two men use three or four sets of forms for curtain walls and piers, no stop need be made.

The water table at the top is not put in place until after the piers and curtain walls have set.

The appearance of this wall is sometimes preferable to a straight wall. The piers are usually made about 12 inches square and the curtain walls about

6 inches thick, although walls of this type have been made as light as 4 inches for curtain walls and 10 inches for piers, according to the weight they have to carry.

Fences, retaining or terrace walls can be constructed in the same manner, with good results.

The curtain walls can be made darker by adding a pound or two of blue or black pecora, (a powder used for coloring) or a mineral paint to each barrel of cement used in making the curtain walls of the foundation, which will make the water table and piers of a much lighter color and give them a more massive appearance.

Walls of this construction, if used below grade, should be carefully plastered with a cement mortar containing water-proofing in order to insure a water-proof wall.

In designing a foundation of monolithic construction, be sure to have the piers placed so they will support the sills or girders of the building.

Monolithic construction is often used under houses which have been erected upon piers with no excavation for cellar. Then if a basement is desired, the excavation is made, footings placed and walls erected between the piers.

Cobble Stone

FOUNDATIONS constructed of cobble stone are not only very expensive, but require considerable time to construct, and skilled workmen must be employed.

The main point which will have to be noticed in this construction of cobble or field stone foundation walls or piers, are the character of the stones, the filling in of the spaces between the stones, the mixture of the mortar and the pointing between the stones of the exposed parts.

Fig. 21 shows foundation of cobble stone.

Stones which are porous should not be put into a wall. It is generally said that stones having the least absorption are the best. To test the absorptive power of the stone, take a few samples and dry them for many hours in an oven, weighing the stone after it has dried out, then soak it in water for say, twenty-four hours and weigh again. The increase in weight of the soaked stone (due to the weight of the water absorbed) divided by the weight of dry stone will give the ratio of the absorption. Good stone will not take up water equal to more than 1/600 of the weight of the stone.

Fig. 21—Construction of cobble stone wall.

If stones are not impervious to water, they are very apt to take in a considerable amount of frost which might result in breaking off small pieces of the stone or fracturing it. Porous stones are also apt to allow efflorescence, which will discolor and weaken the wall.

There are two ways of laying cobble stone walls; that of laying them up in layers in the same manner as you would a brick wall, and by the use of forms. If the former method is employed, it will be impossible to lay more than two feet of wall a day, that is, in height. If more than this is laid in one day, the weight of the top stone is very apt to push the lower ones out of place.

By using forms the wall can be erected as fast as is desired. In this case, the pointing up of the wall will have to be done after the forms have been removed.

If the stones are round or small, they should be split so that the part which is embedded in the mortar will be rough and give the mortar a good chance to adhere to it.

The mortar should be a "dry" mixture and of a good quality of cement mortar, and the spaces in between the stones should be well filled up and neatly pointed upon exposed work.

The mortar used below grade should be of a mixture of coarse sand, Hydrate lime and Portland cement, while above grade, good, common lime, or lime and cement can be used.

Sometimes a good appearance may be obtained by coloring the mortar used in the pointing. Of course, this will depend on the color of the stones used. The mortar can be colored with a powder called pecora, or a mineral paint which is obtainable in most any color. (See coloring of concrete.)

In laying the wall, level it off about every 2 feet so as to keep the stones laid in courses.

Together with the quality of stones and mortar used, the wall must be properly built in order to insure strength. About every 5 feet or 6 feet in each course, a bonding stone should be used, that is, one which runs thru the thickness of the wall, or a three-quarter bond, this being a stone which goes ¾ thru the wall, and adds greatly to its strength. At the corners of the wall, use long stones, laying them alternately. As this will be the weakest part of the wall, it is a good plan to save the largest and best stones for this purpose.

All stones, large and small, should be embedded in mortar and no air spaces left in between them.

If the walls are built in a damp country, they can be plastered on the outside below grade, with hot asphalt, this being applied after the mortar in the joints has been allowed to dry perfectly.

Portland cement is sometimes used for plastering walls below grade in localities where the soil is not too damp, but as it is porous to some extent, is apt to become affected by the elements.

Cobble stone foundations are constructed from 12 inches to 20 inches thick and the footings will have to be made accordingly.

Cobble stones will cost from $1.50 to $2.00 per perch (24¾ cu. ft.).

Ashlar

A FOUNDATION of Ashlar construction is one that has the outside faced with cut stone, that is, the main part of the wall made of concrete, brick or stone, and then a veneer of stone placed on the outside.

This kind of foundation is not used very often, unless for large dwelling houses and public buildings, except in a locality where the stones can be cheaply quarried.

Course work as shown by Fig. 22 is probably the cheapest to construct where stones of specified size can be had easily, as is the case with sand and limestone.

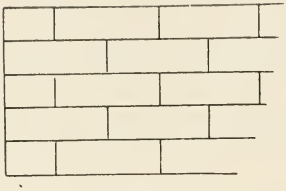


Fig. 22—Ashlar wall.

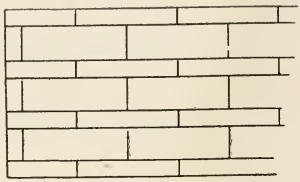


Fig. 23—Ashlar wall.

A wall laid up as shown by Fig. 22 is called "Regular Coursed Ashlar." It has, you will notice, stones of regular size laid up with plumb joints. This kind of Ashlar construction is expensive on account of the stones being of one size, unless they can be quarried to size according to specifications.

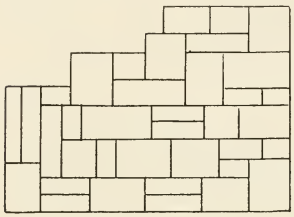


Fig. 24—Ashlar wall.

This method is used mostly in the construction of office buildings and banks, and gives a very pleasing appearance. It is not used very often for foundations on account of the expense.

Fig. 23 shows another kind of Regular Coursed Ashlar with a plumb joint. Two sizes of stone are used in this wall.

Fig. 24 shows the wall laid up with 5 or 6 different sized stones. This is what is called "Irregular Ashlar." This method saves on cost of material, as most any size can be used. But the labor cost would be much more than in the regular coursed walls.

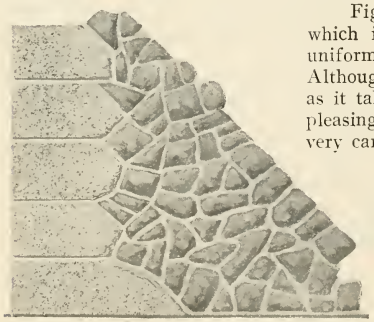


Fig. 25—Ashlar wall.

Fig. 25 shows a broken Ashlar wall, which is sometimes used when stones of uniform size cannot be obtained cheaply. Although this wall costs much more to lay, as it takes much longer, it gives the most pleasing appearance when the work is done very carefully.

The stones which are placed at the corners are called "quoins" and are for the purpose of strengthening the wall. In some cases, these quoins may be made of brick, and the sills and jambs of the windows and doors should be made of the same material as the quoins.

Concrete Floors

NO matter what kind of a foundation wall is used, the floors of an up-to-date basement should be of concrete. The floor should not be put in until the building is practically complete, that is, all plumbing and piping finished. It is a good plan to allow the cellar floor to dry with the interior plaster. No sub-foundation is needed, as a general rule. Level and pack the earth surface and lay down from 2 to 5 inches of concrete of a proportion of one part of cement to two parts of sand and five of crushed stone or gravel. Float smooth, giving all sections a slight slope toward a cess pool or drain in the cellar.

When concrete has become sufficiently hard, apply a top dressing about ½ inch thick, of cement mortar. This dressing should be about 1 to 3 mixture and rounded up and made continuous with side wall finish. Sometimes it is advisable to use a little water-proofing in concrete floors.

Contractors now charge (Jan. 1, 1918) from eight to twelve cents per square foot for this kind of work according to the thickness of the floor. However, the floor can be made for about nine cents per square foot.

To grout one square of cellar floor, it will require the following material mixed to the proportion of 1:2:5, 1 part cement. 2 parts sand, 5 parts crushed stone.

5 sacks of cement at $2.40 barrel	$3.00
1-3 yard sand at $2.00 yard	.67
5-6 yard stone at $3.00 yard	2.50
6 hours labor at 30c hour	1.80
Cost of facing one square	1.05
Total	$9.02

or about 9c per sq. ft.

For the finish, or facing of the floor, it will require about 1½ sacks of cement and 4 cubic feet sand, which will cost about $1.05.

Of late, contractors have allowed a one-piece floor in many cases, and have found it very satisfactory, as there is no top dressing to chip off, which is often the case in a floor made of concrete over which a top dressing of cement has been placed.

When a one-piece floor is put in, use sand and gravel, eliminating the crushed stone. Stakes should be driven around the cellar bottom to give the level to the floor.

When a cement floor surface begins to wear it is often desirable to patch it.

Cut down the worn place at least one and a half inches. This cutting should be carried into the strong unbroken concrete and the edges should be cleanly undercut. The bottom of the cut should then be swept out clean, blown out with compressed air or a pair of bellows, if available, then thoroughly wet and scrubbed with a broom. In this way, small, loose particles of broken material which the chisel has driven into the surface, are removed. A grout made of pure cement and water about the consistency of thin cream, should be scrubbed into the pores with a broom or brush, both at the bottom and sides of the cut. Following this a stiffer grout, about the consistency of soft putty should be thoroughly compressed and worked into the surface

which has already been spread with grout. Finally, before the grout is set a mortar made of one part cement to three parts crushed stone or gravel, consisting of graded sizes from ½ inch down to the smallest excluding dust, should be thoroughly mixed and put in place, then floated to a proper surface. Cover with wet bagging, wet sand, sawdust, or other available material. All trucking should be kept off and the surface kept thoroughly wet for at least one week or ten days.

If a particularly hard surface is required, 6-penny nails are sometimes mixed with the mortar and other nails stuck into the surface when the patch is finished. This will produce a surface which is extremely hard and durable.

Materials for 100 Sq. Ft. of Concrete Floor

Thickness in Inches	Base 1: 2½: 5 Mixture						Wearing Coat 1: 2 Mixture					
	2½	3	3½	4	4½	5	½	¾	1	1¼	1½	2
Barrels Cement	1.10	1.30	1.50	1.78	1.99	2.21	0.56	0.85	1.13	1.41	1.69	2.26
Cu. Yards Sand	0.40	0.47	0.55	0.63	0.70	0.78	0.16	0.24	0.32	0.40	0.47	0.64
Cu. Yards Stone	0.80	0.94	1.10	1.26	1.40	1.56						

Porch Concrete Floors

CONCRETE porch floors can be had for about 15c to 18c per square foot, the work being done by a contractor. The floors should be made about 4½ inches thick. This includes about ¾ inch of cement mortar face.

One square (100 square feet) will cost as follows: (This does not include the work on the forms or cinders for filling in, as concrete porch floors are usually filled in underneath, if they are supported around the outer edges by foundation walls.)

1 yard sand	$2.00
1 yard gravel or stone	2.50
2 barrels cement	4.80
15 hours labor at 30c	4.50
Total	$13.80 or 13¾c per sq. ft.

If the walls of the foundation are constructed out around the porch, it is always advisable to place a couple of small grate ventilators in the walls so that the underside of the porch floor will have a chance to dry out. Otherwise the dampness will deteriorate the concrete to some extent.

The concrete and cement mortar should be mixed in about the same proportion as for cement floors.

Fig. 26—Porch floor held in place with I-beams.

The floor should be well bedded into the supporting piers or walls. Fig. 26 shows method of using channel iron or I-beam in the construction of porch floor. If it is possible to get under porch after the floor has been formed, you can re-

move the boards in between the I-beams; if not, it will do no harm to leave them in.

For tile porch floor, the floor would be constructed in the same manner as for cement. The rough floor should be laid and let set, then the tile embedded in the finish or top dressing.

Concrete Steps

IN determining the materials needed for steps, a careful study of plans will show that a division into simple parts is possible. The treads and risers may be figured by finding the section area and length. Then the amount of material needed for one step should be multiplied by the number of steps.

Providing the material used is of a good grade and mixture, it will not be necessary to use re-inforcements of steel of any kind on ordinary concrete steps.

The cost of concrete steps will depend upon the size. We will use, for example, steps with 8 inch riser, 6 feet wide, 4 steps high and 12 inch tread, steps to be built between the walls or pedestals with riser and tread 4½ inches thick, including face. (See Fig. 27.)

¼ yard sand at $2.00 yard (about)	$0.50
½ yard of gravel and stone at $2.50 yard	1.25
4 sacks of cement at $2.40 barrel	2.40
Lumber and work on forms	3.25
15 hours labor at 30c	4.50
Total	$11.90 or 54c per lineal foot for each step.

The steps will want a solid footing below and good connection to the porch floor at the top.

By referring to Fig. 27 you will notice that the forms are constructed with two pieces of boards held in place between the temporary stringers of the forms. Both pieces are placed between the stringers, the inside piece to be nailed just enough to hold it in place. Then after the concrete or grouting of the steps has set, it is removed. The outside piece then makes the form for the top dressing or finishing of the steps. This outside riser of the forms is constructed with a groove at the top which forms a nosing for each tread. If the concrete steps are constructed between masonry pedestals a form will have to be constructed for the bottom and the two risers held in place by temporary wooden risers or forced between the pedestals.

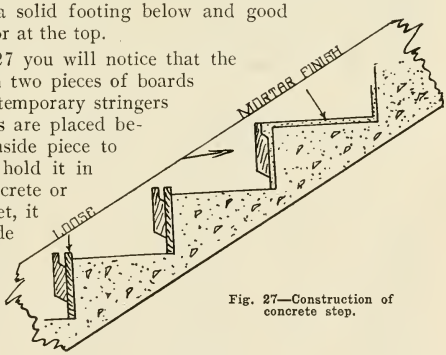


Fig. 27—Construction of concrete step.

TABLE III

Quantities of Material for One Cubic Yard of Rammed Concrete Based on a Barrel of 3.8 Cu. Ft.

Proportions by Parts		PERCENTAGE OF VOIDS										
		50% Broken Stone Screed to Uniform Size					45% Average Conditions		40% Gravel			
Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
			Bbl.	Cu. Yds.	Cu. Yds.	Bbl.	Cu. Yds.	Cu. Yds.	Bbl.	Cu. Yds.	Cu. Yds.
1	1	1.5	3.19	0.45	0.67	3.08	0.43	0.65	2.97	0.42	0.63
1	1	2	2.85	0.40	0.80	2.73	0.38	0.77	2.62	0.37	0.74
1	1	2.5	2.57	0.36	0.90	2.45	0.34	0.86	2.34	0.33	0.82
1	1	3	2.34	0.33	0.99	2.22	0.31	0.94	2.12	0.30	0.90
1	1.5	2	2.49	0.53	0.70	2.40	0.51	0.68	2.31	0.49	0.65
1	1.5	2.5	2.27	0.48	0.80	2.18	0.46	0.77	2.09	0.44	0.74
1	1.5	3	2.09	0.44	0.88	2.00	0.42	0.84	1.91	0.40	0.81
1	1.5	3.5	1.94	0.41	0.96	1.84	0.39	0.91	1.76	0.37	0.87
1	1.5	4	1.80	0.38	1.01	1.71	0.36	0.96	1.63	0.34	0.92
1	1.5	4.5	1.69	0.36	1.07	1.60	0.34	1.01	1.51	0.32	0.96
1	1.5	5	1.59	0.34	1.12	1.50	0.32	1.06	1.42	0.30	1.00
1	2	3	1.89	0.53	0.80	1.81	0.51	0.76	1.74	0.49	0.74
1	2	3.5	1.76	0.49	0.87	1.68	0.47	0.83	1.61	0.45	0.79
1	2	4	1.65	0.46	0.93	1.57	0.44	0.88	1.50	0.42	0.84
1	2	4.5	1.55	0.44	0.98	1.48	0.42	0.94	1.41	0.40	0.89
1	2	5	1.47	0.41	1.03	1.39	0.39	0.98	1.32	0.37	0.93
1	2	5.5	1.39	0.39	1.08	1.31	0.37	1.01	1.25	0.35	0.97
1	2	6	1.32	0.37	1.11	1.25	0.35	1.06	1.18	0.33	1.00
1	2.5	3	1.72	0.61	0.73	1.66	0.58	0.70	1.60	0.56	0.68
1	2.5	3.5	1.62	0.57	0.80	1.55	0.55	0.76	1.49	0.52	0.73
1	2.5	4	1.52	0.54	0.86	1.46	0.51	0.82	1.40	0.49	0.79
1	2.5	4.5	1.44	0.51	0.91	1.37	0.48	0.87	1.31	0.46	0.83
1	2.5	5	1.37	0.48	0.96	1.30	0.46	0.92	1.24	0.44	0.87
1	2.5	5.5	1.30	0.46	1.01	1.23	0.44	0.95	1.17	0.41	0.91
1	2.5	6	1.24	0.44	1.05	1.17	0.41	0.99	1.11	0.39	0.94
1	2.5	6.5	1.18	0.42	1.08	1.12	0.39	1.02	1.06	0.37	0.97
1	2.5	7	1.13	0.40	1.11	1.07	0.37	1.05	1.01	0.36	0.99
1	3	4	1.42	0.60	0.80	1.36	0.36	0.77	1.30	0.55	0.73
1	3	4.5	1.34	0.57	0.85	1.28	0.55	0.81	1.23	0.52	0.78
1	3	5	1.28	0.54	0.90	1.22	0.52	0.86	1.17	0.49	0.82
1	3	5.5	1.22	0.52	0.94	1.16	0 49	0.90	1.11	0.47	0.86
1	3	6	1.16	0.49	0.98	1.11	0.47	0.94	1.05	0.44	0.89
1	3	6.5	1.12	0.47	1.02	1.06	0.45	0.97	1.01	0.43	0.92

From "Concrete—Plain and Reinforced" by Taylor and Thompson

Cement Walks

CEMENT walks are extensively laid all over the country. They are preferred on account of their smooth and even surface, and when properly laid, are very durable and much cheaper than stone or bricks. They should be laid, however, where there is no danger of the grade being altered and only after the earth has become thoroughly settled.

Their durability will depend upon the thickness and kind of cement used. Portland cement is to be preferred.

For first class work, cement walks must be laid as follows:

The ground should be leveled off from 8 to 15 inches below the finished grade of the walk and well settled by tamping or rolling. The colder the climate the deeper the excavation. Then remove all top soil or sod. If necessary to obtain the desired grade make the sub-base thicker. If the sub-soil is water tight (clay for instance) use blind drain leaders so no water can stay under the walks and lift it when freezing. Then construct the form on each side of the walk. Pieces of 2x6 held in place with stakes are all that will be necessary for this work. The top of these pieces of 2x6 should be kept on a level so they can be used for leveling top of walk. Then a foundation should be laid of coarse gravel, stone chips, sand or cinders, well tamped, rolled and wet down. These materials are excellent for sub-base as they facilitate drainage. This material should be from 3 to 7 inches thick. Then prepare the concrete by mixing one part of cement, one part of sand and three or four of coarse gravel and stone, in a dry state. First mix the sand and cement thoroughly together; then mix in the stone. Now add sufficient water from a pail or sprinkler, to make a good mortar. The concrete should then be placed in layers and thoroughly tamped. See paragraph on mixing concrete.

Before the concrete has set, the finishing coat should be applied. If the concrete gets dry, the finishing coat will not adhere to it in the proper manner. The top should be prepared by mixing one part of Portland cement to one and two parts of fine, sharp sand or to one part of sand and one part of crushed granite. Apply this top coat carefully with straight edges and trowel down to a smooth surface.

TABLE

Materials for 100 Sq. Ft. of Cement Sidewalk

Concrete Base or Grout.

Thickness Inches	Proportions—1, 2½, 5			Proportions—1, 3, 6		
	Cement Bbls.	Sand Cu. Yds.	Stone Cu. Yds.	Cement Bbls.	Sand Cu. Yds.	Stone Cu. Yds.
2½	1.10	0.39	0.78	0.94	0.40	0.80
3	1.33	0.47	0.94	1.13	0.48	0.96
3½	1.55	0.55	1.10	1.32	0.56	1.12
4	1.77	0.63	1.25	1.51	0.64	1.28
4½	1.99	0.70	1.41	1.70	0.72	1.44
5	2.21	0.78	1.56	1.89	0.80	1.60

Wearing Surface or Top Coat.

Thickness Inches	Proportions—1, 1		Proportions—1, 1½		Proportions—1, 2	
	Cement Bbls.	Sand Cu. Yds.	Cement Bbls.	Sand Cu. Yds.	Cement Bbls.	Sand Cu. Yds.
½	0.85	0.12	0.68	0.14	0.56	0.16
¾	1.28	0.18	1.02	0.21	0.85	0.24
1	1.70	0.24	1.36	0.29	1.13	0.32
1¼	2.13	0.30	1.70	0.36	1.41	0.40
1½	2.56	0.36	2.04	0.43	1.69	0.47
2	3.41	0.48	2.72	0.57	2.26	0.63

Table Taken from "Concrete Plain and Reinforced," by Taylor and Thompson.

Example: What materials will be required for a walk 8 ft. wide and 150 ft. long, the base to be 3 in. thick, of concrete in proportions 1 :3 :6, and the wearing surface 1 in. thick, in proportions 1 part cement to 1 part sand?

Solution: Referring to the table, we find directly that for 100 sq. ft. of base 3 in. thick, 1.13 bbls. of cement, 0.48 cu. yds. of sand and 0.96 cu. yds. broken stone are required. Similarly, for 100 sq. ft. of wearing surface 1 in. thick you should require 1.70 bbls. of cement and 0.24 cu. yds. of sand. For each 100 sq. ft. of completed walk there would therefore be needed 2.83 bbls. of cement, 0.72 cu. yds. of sand and 0.96 cu. yds. of broken stone; and since there are 1,200 sq. ft. in an area of 150x8 ft., for both base and wearing surface we should require 34 bbls. of Portland cement, 9 cu. yds. sand, 12 cu. yds. broken stone.

After the walk has been troweled down to a smooth surface, mark it off in sections from 5 to 7 feet square with a tool made for that purpose. This adds to the appearance and allows for expansion or contraction. They extend through the full thickness of the concrete and are sometimes filled with tar paper or some other water-proofing material. A water tight (contraction) joint may be made by leaving a slit about ½ inch wide and filling this with plastic material, one of the best for this being pure asphalt of medium hardness. Stone dust is sometimes mixed with the asphalt. Another way of forming a joint is to insert two or more thicknesses of tarred felt. The edges next to the 2x6's should be rounded, as this will prevent them from breaking off. The walks should be kept covered with straw, shavings, paper or canvas to prevent them drying too quickly. It is also a good plan to sprinkle with hose for five or six days.

Trees are not injured in the least by cement sidewalks. The roots should be cut away to the depth of 6 or 8 inches below the excavation and the concrete kept away from the trunk, exposing enough soil to absorb the necessary moisture and allowing for growth of tree.

Actual Costs on 1000 Square Feet of Sidewalk

Thickness	Mix	Yds. Sand	Bbls. Cement	Cost Water	Cost Sand	Cost Cement	Cost Labor	Total Cost
2″	1:2	6.17	20.81	$.39	$12.34	$49.94	$6.35	$69.02
2″	1:3	6.17	13.88	.37	12.34	33.31	6.35	52.37
2″	1:4	6.17	10.41	.35	12.34	24.98	6.35	44.02
2″	1:5	6.17	8.33	.34	12.34	19.99	6.35	39.02
2″	1:6	6.17	7.11	.33	12.34	17.06	6.35	36.08
2½″	1:2	7.71	26.02	.44	15.42	62.44	7.67	85.97
2½″	1:3	7.71	17.35	.41	15.42	41.64	7.67	65.14
2½″	1:4	7.71	13.01	.39	15.42	31.22	7.67	54.70
2½″	1:5	7.71	10.40	.38	15.42	24.96	7.67	48.43
2½″	1:6	7.71	8.67	.37	15.42	21.20	7.67	44.66
3″	1:2	9.25	31.21	.49	18.50	74.90	9.20	103.09
3″	1:3	9.25	20.82	.47	18.50	49.96	9.20	78.13
3″	1:4	9.25	15.61	.46	18.50	37.46	9.20	65.92
3″	1:5	9.25	12.49	.45	18.50	29.97	9.20	58.12
3″	1:6	9.25	10.66	.44	18.50	25.58	9.20	53.72
4″	1:2	12.34	41.62	.59	24.68	99.88	12.70	137.85
4″	1:3	12.34	27.76	.57	24.68	66.62	12.70	104.57
4″	1:4	12.34	20.82	.55	24.68	49.96	12.70	87.89
4″	1:5	12.34	16.66	.53	24.68	39.98	12.70	77.89
4″	1:6	12.34	13.88	.52	24.68	33.31	12.70	71.21

The above table was completed from about 10 miles of sidewalk at the following prices. Common labor cost $2.50 per ten hour day and the finisher was paid $3.50 per day. Cement cost $2.40 per bbl. Stone and sand at an average price of $2.00 per yd. The above table you will notice does not allow for any sub-soil and material for forms. The material was also mixed by a machine. Hand mixed would cost considerably more.

Piers

THE girder piers which are to support the girder or sills are generally constructed with the same kind of material as the foundation, upon footings of the proper size. Forms for girder piers are shown by Fig. 28 and should be constructed of the proper height and thickness as shown on blue prints furnished for your building. Be sure that all piers have good footings and are set on solid soil.

Concrete piers will cost about 35c per foot in height for a 12x12 inch pier, which includes the cost of constructing the forms.

To find the amount of material necessary for your piers take the total number shown on plan and multiply by the length of each and add the amount in the footings. For example: If your foundation plan shows 7—12x12 piers supporting the girders and each pier is 6 ft. 4 in. high.

6 ft. 4 in. x 7 ..... 44 1/3 cu. ft.
7 footings, 20x20x8 ..... 13 cu. ft.

Total ..... 57 1/3 cu. ft.
57 1/3 cu. ft. at 35c $20.07

For 8x8 in. piers:

6 ft. 4 in. x 7 ..... 44 1/3 lineal ft. 8x8 piers
1 ft. of 8x8 in. piers ..... 4/9 cu. ft.
4/9x44 1/3 ..... 19 2/3 cu. ft.
7 footings, 16x16x8 ..... 8 1/3

Total ..... 28 cu. ft.
28 cu. ft. at 35c $10.60

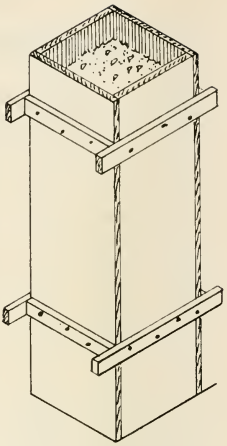


Fig. 28—Forms for girder concrete piers.

In some localities, if it can be obtained, 6 inch gas pipe with a flange screwed on top and bottom, makes a good girder pier, much easier to construct and takes up much less room. It is to be doweled into concrete footings and fastened to sill at top with lag or set screws.

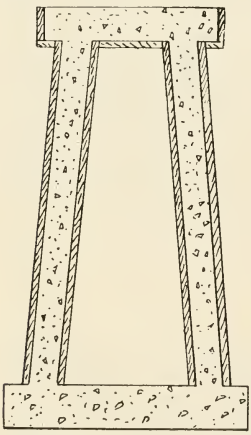


Fig. 29—Construction of tapering concrete pier.

Brick piers are also used considerably for girder supports and vary in cost according to size. Use the following to find the number of bricks required.

Size of Piers. Inches.	No. of Bricks per Foot of Height.
8¼x 8½	9
8¼x13	14
8¼x17½	19
8¼x22	23
13 x13	22
17½x17½	40
22 x22	62
26½x26½	90
30½x30½	120

Example: If you have 7 piers 6 ft. 4 in. high.

7 x 6 ft. 4 in. ..... 44 1/3 lineal ft.
44 1/3 x 22 (for 13x13 pier) ..... 975 bricks
Cu. ft. concrete in footings ..... 13 cu. ft.

(See cost of laying brick under chapter "Brick.")

When using brick piers as in other brick work it is always advisable to use a "course stick" which is a measuring pole the total height of the work.

Upon this pole you can divide off your different courses so as to have the bricks and joints come out evenly at top.

Porch piers and pedestals are constructed of cement, brick and stone, and this work will cost considerably more than material of the same nature when worked into foundation.

Fig. 30—Construction of straight concrete pier.

Fig. 31—Construction of brick pier with stone cap.

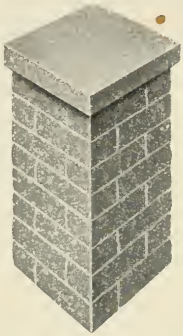


Fig. 32—Construction of cement block pier with cement cap.

The piers should be constructed to harmonize with the foundation walls, not necessarily out of the same material, as combinations, when properly used, look well. A brick and stone or stucco and cement blocks will look very good.

The porch piers should be made in size to harmonize with the columns resting upon them and also by the weight (in appearance of the balance of the porch). Nothing looks quite so unsightly as a large, heavy porch frame supported by small, scrawny columns or vice versa.

Figs. 29, 30, 31, 32 give illustrations of the construction and method of building different porch piers.

Fig. 29 shows construction of tapering pier of concrete. Considerable material can be saved by using wood core on inside of the pier.

Fig. 30 shows construction of straight concrete pier with concrete cap. The larger pier can be filled in with large stones, cinders or old brick to cut cost and will not affect strength as long as they are well embedded in concrete.

Fig. 31 shows construction of brick pier with stone cap.

Fig. 32 shows cement block pier with cement cap. (See paragraph on Cement Blocks.)

Brick

BRICKS are classified according to the manner of molding; the place they occupy in kiln during the burning or curing, and according to their shape or the size in which they are to be made.

When distinguished according to the manner of molding, bricks are named:

Soft mud brick: Made of very wet mud.

Stiff mud brick: Made of mud with less water.

Dry pressed brick: Made of clay containing about 6 per cent. moisture.

In the old style kiln, the bricks were not all burned alike. Those adjacent to the fire were overdone, those farthest away from the fire, underdone, and only the ones in the center were burned satisfactorily. These conditions placed many grades of brick on the market, some of which were classed face, ornamental, compass, feather edge, paving, sidewalk and sewer.

Bricks are more extensively used than any other material in building construction in general, and are fast taking the place of wood in the construction of larger buildings. In frame dwelling houses, their use has been confined mostly to the building of foundations, piers and chimneys.

Good bricks are preferable to stone, as they are practically indestructible, either by fire or the elements in the atmosphere or ground. They may be bought or made in any shape, size or color and in some localities are much cheaper and easier to handle in the building of a wall than stone. However, all bricks are not the same; many are porous and soft and cannot be used except in the driest climates.

We will not go into detail as to the manufacturing of brick as the average builder does not care how and from what brick are manufactured, just as long as the desired results are obtained by using them. Bricks are colored by the use of mineral paints and can be obtained in all shades of red, pink, brown, cream or yellow. Some of these colors can be used together and an artistic appearance obtained.

There are no legal standard sizes of brick used in this country and they will vary in sizes from 7½x3⅜x2⅜ to 9⅛x4⅝x2⅜, according to the make and kind. The standard brick which has been adopted by several builders' associations and makers is 8¼x4x2¼ for common, and 8⅜x4⅛x2¼ for face and fancy brick.

The weight of a brick will also vary according to the kind of clay used and, of course, to the size. Common brick will weight from 4¼ to 4¾ pounds, or about 120 pounds per cu. ft., and pressed brick from 5 to 5¾ pounds, or about 130 pounds per cubic foot.

Good building brick should be sound, free from cracks, pores, stones or lumps of any kind, especially of lime.

To have a good looking job when finished, all the bricks should be of uniform size and with sharp, square edges. Some bricks, when allowed to dry in the open, are occasionally caught by a shower, which will give a pitty effect and sometimes take off the sharp edges.

All surface brick should be sound and well burned. Good brick will give out a ringing sound when they are hit together. A dull sound indicates that the brick is soft. The poorer grades can be used sometimes for filling in on the inside of the wall.

A good brick will not absorb more than from five to eight per cent. of its weight while a poor and unsound brick will sometimes absorb as much as 25 per cent of its weight of water.

If a brick stands in still water for an hour and the moisture rises more than ½ an inch, it is not a first class brick; if the moisture rises 2 inches its use for facing is questionable; if the moisture rises 3 inches it should not be used on any outside work of importance.

In order to build any kind of a strong and durable piece of work, it is necessary to have some kind of a bed of mortar placed between the bricks. Therefore, brickwork consists of two things, brick and mortar.

The durability and strength of any piece of work depends on the kind of brick and mortar used and also the bonding and joints.

The mortar used in laying brick below ground should be made of hydraulic lime or cement mortar, while above grade, common white lime to which a little cement has been added, will give sufficient strength to the wall.

The mortar joints of common brick vary from about 3-16 to ⅜ of an inch in thickness. The brick should be well embedded in mortar so as to form a solid mass and kept from dampness as much as possible so that the mortar will not lose any of its strength.

The mortar has three functions in brick work.

(1) To keep out wet and change in temperature by filling all crevices.

(2) To unite the whole into one mass.

(3) To form a cushion to take up any inequalities in the bricks and to distribute the pressure evenly.

Fig. 33 shows the different kinds of joints of brickwork. All of these have been used more or less in this country. The joints used will depend upon the kinds of brick and also the conditions to which they are exposed.

Fig. 33 (A) shows a smooth plumb joint; (B) shows a rough plumb joint; (C) a smooth inset joint; (D) a rough inset joint; (E) a round or curved joint; (F) a beveled or V shaped joint; (G and H) show two different patterns of "struck" joints.

Good brickwork depends much on workmanship. It is impossible to make a good looking wall with poor material; it is easy to make a poor looking job with the best brick and mortar obtainable.

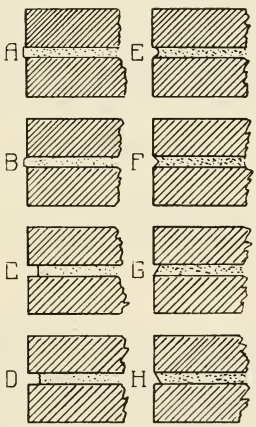


Fig. 33—Different joints used in brick wall.

The bonding of the brick is very important. In using the word "bond",

we mean the manner in which brick is connected with the rough brickwork or "backing-up" wall, and also the pattern which is worked in brick and mortar on the face of the wall.

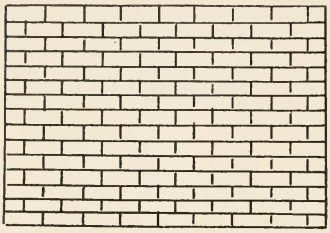


Fig. 34—View of running bond of brick wall.

The most common bond used in this country is the running bond, which is illustrated by Fig. 34. This is not a good method of laying brick as it does not look artistic and the "face" wall does not have sufficient tying to the "backing-up" wall or rough brickwork. It is used mostly in warehouses and factories.

There are a number of different ways of bonding brick, which will give a pleasing and artistic pattern to a wall.

Fig. 35 shows the bonding of brick with a header brick placed between every other face brick. This gives a very pleasing appearance and is often used by some of the best bricklayers in the country.

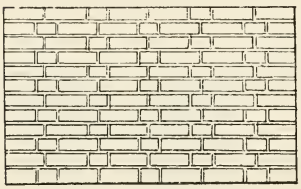


Fig. 35—Bonding brick wall.

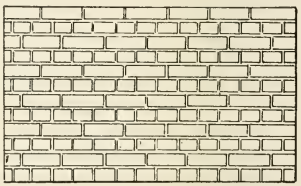


Fig. 36—Method of bonding brick.

Fig. 36 shows a layer of brick and one of headers tying brick to the rough wall. A header brick placed in between every other face brick will give an artistic pattern when it is of a lighter shade than the face brick, as shown by Fig. 37.

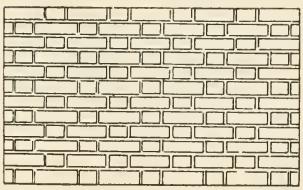


Fig. 37—Bonding brick wall.

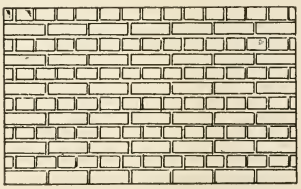


Fig. 38—Bonding brick wall.

Fig. 38 shows practically the same brick as Fig. 36, but bonded in a little different manner.

Fig. 39 and 40 show different ways headers can be placed in a wall, chimney or pier in order to give an artistic pattern to the work.

Bricks are often made of cement and are on the market in many places. They are generally used for facing purposes. They have about the same characteristics as cement blocks and the results of one product are generally true of the other. They are manufactured by machine, by hand or power press.

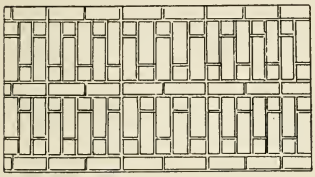


Fig. 39—Pattern of brick wall.

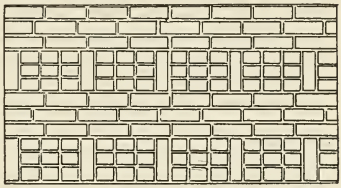


Fig. 40—Pattern of brick wall.

Other conditions being equal, wet concrete mixture tends to density, non-absorption and fineness of face.

Concrete attains its normal strength when it is seasoned. Cement brick should not be used earlier than two weeks after being manufactured. They should be wet down each day for about ten days and not allowed to dry in too fast a temperature.

Cement, sand and stone mixture are much stronger, more dense and less absorbent; and require less cement than cement and sand alone. One part of cement to four of sand, or one part of cement to three of sand and three of aggregate from ¼ to ½ an inch in size, are given as minimum proportion of cement for cement brick.

Much depends on the character of the sand. It should contain both fine and coarse grain and be clean and sharp. (See paragraph on sand.)

By the selection of the color, shape and size of the aggregate and by the subsequent treatment, either by working with acid or with water and stiff brushes, the faces of the bricks may be given various textures and colors. Various colors also are used in the cement.

Material Required for 1000 Brick

In regard to the cost of making Brick, which may vary in different localities, one can figure cost from the following data for each thousand brick.

Mixture	Cement		Sand
A 1:3 brick takes	3.8 Bbls.	and	1.7 Cu. Yds
A 1:4 brick takes	3.05 Bbls.	and	1.8 Cu. Yds.
A 1:5 brick takes	2.55 Bbls.	and	1.9 Cu. Yds.
A 1:6 brick takes	2.18 Bbls.	and	2.0 Cu. Yds.
A 1:7 brick takes	1.9 Bbls.	and	2.0 Cu. Yds.

Laying Brick Foundation

It is first necessary to prepare a footing which will be of good proportion to the size of the wall that is to be used. Ordinarily, a foundation wall of brick is not made less than the length and width of a brick, which will be about 12½ to 13½ inches, according to the size of the brick, and thickness of the joints used.

In laying brick, it is absolutely necessary that the spaces between them are well filled up with mortar. It is advisable, in most cases, to use a mortar that is thin enough to "spread", but not so thin that it will run.

The brick should be laid so that there are no straight joints, that is, one joint over another, and the corners should be bonded together in good shape, as this is the weakest part of the wall.

Different colors of mineral pigment or pecora can be mixed with the mortar so as to color it to make a contrast with the brick. For instance, dark red face brick embedded in a black mortar will give a good appearance.

All the joints of face brickwork above grade should be "struck" and made with a drip joint. If this is not done, water is apt to work into the mortar and weaken the wall. (See Fig. 33.)

Except in freezing weather, brick should always be laid wet. In hot weather, it is impossible to get the brick too wet. If this is not done, the bricks that are porous to some extent are liable to adhere all the moisture in the mortar and thereby prevent its proper setting.

The wetting of very porous brick is one of the most important steps of obtaining a strong wall, but as this makes the work and handling of the brick much more difficult, the masons do not like to wet them in many cases, unless they are obliged to.

Brick should not be laid in freezing weather unless it is necessary. In such cases, the materials should be heated with the use of Salamanders and the wall protected from the frost at night by covering it with straw and paper. If the top layer should freeze before it sets, it should be removed and the brick cleaned off before used again.

A wall should also be protected from rain as much as possible because if the mortar has not set, the rain will wash some of it out of the joints, and will also stain the wall.

In laying out your brick work, always take into consideration your openings, spaces between openings and height up from starting point. Use a course stick and lay out upon it the number of courses and thickness of joints accordingly so that the work will look even around the entire building. A variation in the thickness of the joints will not be noticeable if worked in gradually, but put them as even as possible. Keep plumb lines and level continually in use. No brick work will look well unless kept square, plumb and level.

Cost of Brick Work

Of course, the cost of brickwork will all depend on the kinds of brick used. They will vary in cost from $8.00 to $60.00 per thousand.

Retail price quoted at Bay City January 1st, 1918:

Common Brick	$12.00
Common Cherry Red	18.00 to $20.00
Select Cherry Red	25.00 to 30.00
Fire Brick	60.00
Fancy Tapestry	50.00
Fire Clay	1.00 per Hundred
Lime	.50 per Bu. (Lump)
Hydrate	15.00 per Ton
Hair	.60 per Bu.

A mason should lay about 1,400 bricks per day, working 8½ hours, that is, on small, ordinary wall work. The number, of course, will be more for large walls, and for face or fancy pressed brick it will sometimes drop to 300 per day, such as work on fireplaces, fancy porch piers, cornice work, etc. The following table will be based on common brick such as are used in a basement wall.

A 13 inch wall requires about 21 bricks per square foot. Cost of 13 inch wall, common brick:

1,000 Bricks. Average price	$15.00
Mortar	2.25
Mason laying 1,400 per day, at 60c per hour	3.64
Helper at 30c per hour	1.82
Total	$22.71 per M.

Brick Piers

For example, we will use 13 inch pier 7 feet high, which will require about 22 bricks to the foot.

154 Bricks at $15.00 per M.	$2.31
3 Hours Mason and Tender at 90c	2.70
Mortar	.20
Total cost of 13 inch pier 7 feet high	$5.21

The following tables give the number of bricks in 8 inch, 12 inch and 16 inch foundation walls under buildings 16x16 to 50x60.

TABLE V

Number of Bricks in Foundation Wall 8-Inches Thick

Standard Brick 8¼ x 4 x 2¼

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
16	6272	6664	7056	7448	7840	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14896
18	6664	7056	7448	7840	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14896	15288
20	7056	7448	7840	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14896	15288	15680
22	7448	7840	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14896	15288	15680	16072
24	7840	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14896	15288	15680	16072	16464
26	8232	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856
28	8624	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248
30	9016	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640
32	9408	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032
34	9800	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424
36	10192	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816
38	10584	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208
40	10976	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600
42	11368	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600	19992
44	11760	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600	19992	20384
46	12152	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600	19992	20384	20776
48	12544	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600	19992	20384	20776	21168
50	12936	13328	13720	14112	14504	14986	15288	15680	16072	16464	16856	17248	17640	18032	18424	18816	19208	19600	19992	20384	20776	21168	21560

TABLE VI

Number of Bricks in Foundation Wall 12 Inches Thick

Standard Brick 8¼ x 4 x 2¼

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
16	9408	9996	10584	11172	11760	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344
18	9996	10584	11172	11760	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932
20	10584	11172	11760	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520
22	11172	11760	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108
24	11760	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696
26	12348	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284
28	12936	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872
30	13524	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460
32	14112	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048
34	14700	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636
36	15288	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224
38	15876	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812
40	16464	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400
42	17052	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400	29988
44	17640	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400	29988	30576
46	18228	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400	29988	30576	31164
48	18816	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400	29988	30576	31164	31753
50	19404	19992	20580	21168	21756	22344	22932	23520	24108	24696	25284	25872	26460	27048	27636	28224	28812	29400	29988	30576	31164	31752	32340

TABLE VII

Number of Bricks in Foundation Wall 16 Inches Thick

Standard Brick 8¼ x 4 x 2¼

	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
16	12992	13804	14616	15428	16240	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856
18	13804	14616	15428	16240	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668
20	14616	15428	16240	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480
22	15428	16240	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292
24	16240	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104
26	17052	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916
28	17864	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728
30	18676	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540
32	19488	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352
34	20300	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164
36	21112	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976
38	21924	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788
40	22736	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600
42	23548	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600	41412
44	24360	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600	41412	42224
46	25172	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600	41412	42224	43036
48	25984	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600	41412	42224	43036	43848
50	26796	27608	28420	29232	30044	30856	31668	32480	33292	34104	34916	35728	36540	37352	38164	38976	39788	40600	41412	42224	43036	43848	44660

Brick Veneer

It is quite common in many parts of the country to build dwellings with the frame work of wood and the outer walls of brick veneer. Houses constructed in this manner have the same appearance both outside and in, as a solid brick wall.

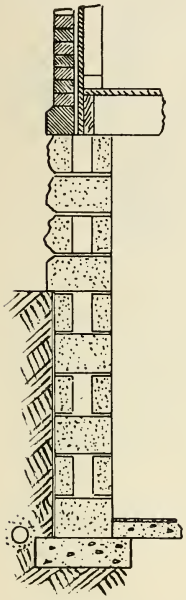


Fig. 42.

The advantage of brick veneer construction over the solid wall is the low cost, and the air spaces between the brick and wood frame. The latter prevents any possibility of the passage of moisture and also makes the house much warmer in winter and cooler in summer.

The cost of brick veneer construction varies in different parts of the country, as in some parts lumber will be cheap and brick expensive, or vice versa, but it is generally considered much cheaper to use brick veneer, although not considered a good method by builders in general.

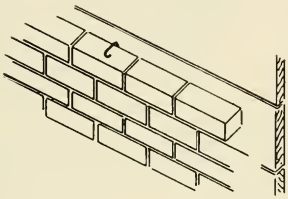


Fig. 43—Method of tying brick veneer.

The advantage of brick veneer over frame walls is that it will reduce the insurance rate considerably over an ordinary frame building, as the veneered walls protect the wood frame from fires in the surrounding property.

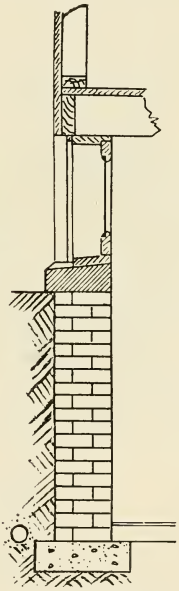


Fig. 41—Foundation wall, brick construction.

You will notice by referring to Fig. 42, which shows the construction of a foundation wall for brick veneer, that it is necessary to make the wall much heavier and it should be built so as to project 6 inches around the frame of the building.

It is very important that the frame of the building be well braced and perfectly plumb and straight.

The bricks are tied to the frame in a number of different ways. A tie, as shown by Fig. 43, which is an example of the method in which the bricks are

tied to the frame, is often used, although a number of builders use an ordinary spike. Each brick in every fourth course should be tied to the frame.

In damp climates, it is a good plan to lay a 2 inch V shaped drain underneath the air spaces in the wall and drain this into cellar in order to take care of any moisture that might work thru the veneer walls. (See Fig. 44.)

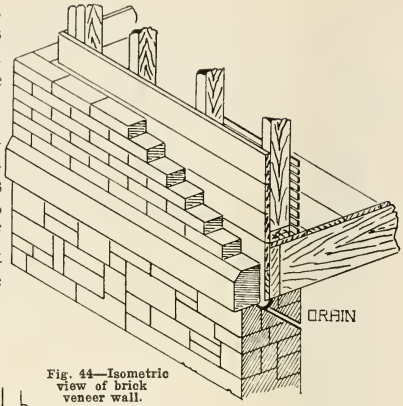


Fig. 44—Isometric view of brick veneer wall.

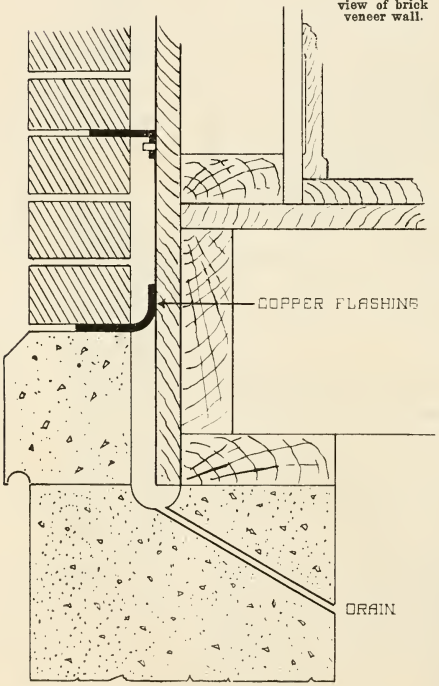


Fig. 45—Section of brick veneer wall showing copper flashing.

Another method is often used to drain off any water that may work its way thru the wall, into the air spaces; that is, by placing a copper flashing against the sheathing, letting it run down over the stone sill or water table. The water will then run out thru the holes which are placed occasionally on the top of the water table. (See Fig. 45.)

The brick for a veneer wall should be laid with a "struck" drop joint which will help to prevent any water from working its way thru the wall.

Above every window and door of a brick veneer wall, angle irons are used in order to support the stone or brick over the openings. (See Fig. 46.)

The metal ties are embedded into the mortar joints. It is very important that non-porous

bricks are used and that a good joint is made and is well filled with a good mortar.

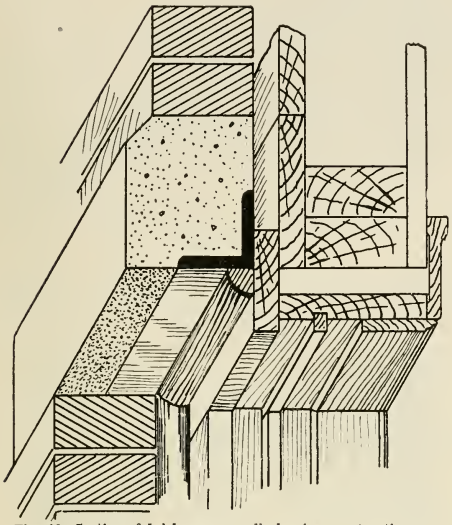


Fig. 46—Section of brick veneer wall showing construction over window opening.

Figs. 47 and 48 show metal ties used in bonding veneer walls.

In order to indicate brick bonds, and solid brick walls, half brick are occasionally used in the wall. This will also aid the appearance.

In using brick veneer a "course stick" should be used in the same manner as in ordinary brick work to space the brick evenly between the openings and the top and bottom of the walls.

The frame work of a brick veneer building should be constructed as rigid and as dry as possible. The frame should also be given time to settle before bricks are veneered on.

To obtain the cost of brick veneer for a wall, it will first be necessary to find the number of square

Fig. 47.

Fig. 48.

yards of wall you will have to cover. The following table will give you the number of brick per surface yard:

Size of Brick.	Thickness of Joints.	No. of Brick per Surface Yard.
8¼x4x2¼	1/2	52
8¼x4x2¼	1/4	58
Pressed brick		
8⅜x4⅛x2¼	3/16	62

A good bricklayer will lay 500 common or about 375 pressed bricks on a veneer wall in a day of eight hours, with one helper. Therefore, it will cost $14.40 to lay 1,000 common bricks (mason at 60c per hour and helper at 30c per hour), and about $19.20 to lay 1,000 pressed bricks.

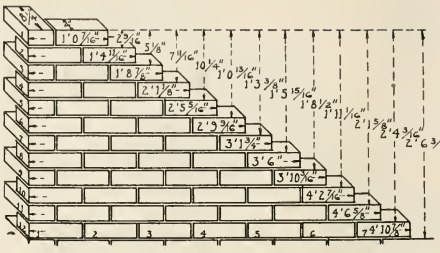


Fig. 47-A shows diagram of coursing for 8¼x4x2⅔" brick 3/16" joint.

Common bricks will cost from $8.00 to $16.00 per M., pressed brick from $18.00 to $30.00 per M.

It takes about 1½ barrels of lime and one yard of sand to lay 1,000 bricks. Of course, this will depend upon the size of joint used.

If you wish the mortar to be colored, refer to paragraph on coloring concrete.

The angle irons which are used to support the brick or stone above the window and door openings will cost about 20c per foot.

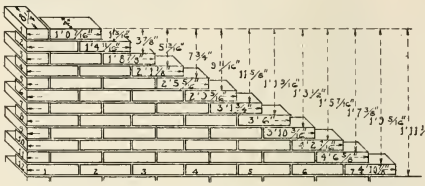


Fig. 48-B shows diagram of coursing for 8¼x4x1¾" brick 3/16" joint.

Cut stone which is used for window and door sills, caps and water table is measured by the cubic foot and will cost from $1.35 to $1.85 per cubic foot, cut and surfaced.

Chimneys

THE chimney is probably one of the most important parts of a dwelling house. It is essential in order to obtain the proper degree of heat and also to discharge the waste products caused by the combustion of the fuel in such a manner so as not to cause any inconvenience to the surrounding property or to the dwelling itself.

It is necessary that the chimney be erected with as good material and workmanship as possible. There are mistakes made in the erection of chimneys, which are too numerous to mention.

The most important things to look after when building a chimney in order to obtain good results are:

(1.) To have the flue of proper size and the chimney of the proper height.

(2.) To build the chimney of good material and have the joints well filled so that no gas will escape into the building.

(3.) To have the inside of the chimney well lined or plastered, which will do away with friction and insure a smooth flue.

(4.) Build a straight flue if possible, that is, do not have an offset in chimney unless absolutely necessary.

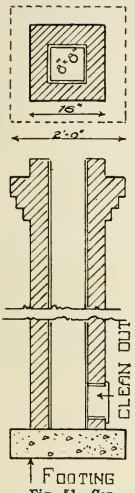


Fig. 51—Construction of 8x8 inch flue chimney.

Every furnace and fireplace should have a separate flue extending to the top of the chimney. Two or three stoves may be connected with one flue and the kitchen range connected with the furnace flue without bad results, providing the flues in both cases are large enough. For ordinary stoves and small furnaces an 8x8 inch flue is sufficiently large, providing it is built so that the inside is smooth, but it generally is better to build furnace and fireplace flues 8x12 inches, unless for a very small fireplace or heating plant. We have found that the best flue is one which has been lined with fireclay tiles, as they are imperishable and cannot be rotted away by rust or acid as is the case with galvanized iron or any metal flue lining.

Flues smoke or draw poorly more often on account of the insufficient height of the chimney than from any other cause. A chimney should always extend a little above the highest point of the buildings surrounding it, otherwise eddies formed by the wind may cause downward draughts in the flues, causing them to smoke. If it is impractical to carry a chimney above the highest point of the roof, it should be topped

Fig. 49—Faulty chimney top.

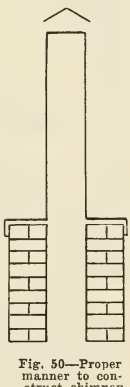


Fig. 50—Proper manner to construct chimney hood.

off with a hood, open on two sides, the sides parallel with the roof being closed. Be very careful that the hood is properly constructed. Fig. 49 shows a faulty top. Fig 50 shows the proper manner in which to construct a hood.

The walls and partitions of a chimney should be built with the greatest care and the joints carefully filled with mortar. Where no flue lining is used, the joints should be "struck" and the walls of the flue made as smooth as possible. It is also a good plan to plaster smoothly on the inside of the flue with Portland cement mortar, as this will increase the draught, prevent sparks and gases from passing thru the chimney and will not become affected by the heat.

In building a chimney, more or less mortar and pieces of brick will lodge in the bottom of it. An opening should be left here in order to clean the material out after the chimney is finished. This opening can be bricked up afterward or covered with a metal door. If chimneys have to be built with a bend or offset in the flue, openings should be left here in order to clean out any mortar and pieces of brick that may lodge there during the construction of the chimney.

Fig. 51 shows the construction of the 8x8 one-flue chimney.

Fig. 52 shows the construction of a two-flue chimney which may be used for furnace and range.

Fig. 53 shows the construction of a wooden ledge or bracket upon which chimneys are often built in small cottages. This will cut out the cost of constructing chimneys from grade up.

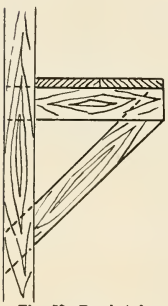


Fig. 53—Bracket for chimney.

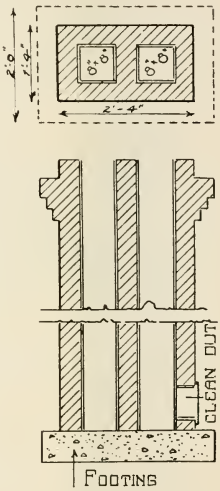


Fig. 52—Construction of two flue chimney.

The work of building chimneys is usually let to a mason contractor, by the lineal feet in height. The average price for labor on an 8x8 one-flue chimney is 75c per lineal ft. in height, double flue, $1.15, and fireplace, $2.00 to $3.00, depending upon the size and construction.

If the builder wishes to handle the chimney work himself, he can estimate a good brick layer and helper will lay five or six hundred brick a day, working 8½ hours.

If you desire to obtain a fairly close estimate as to the number of brick necessary for a plain chimney, one of the methods described below can be used.

If it is figured that five courses of brick in a chimney will make one foot of height, taking into account the thickness of the mortar joints and that five bricks in a course will make a 4x8 flue, then 5x5 equals 25 bricks necessary for one foot of height, in chimney with a 4x8 inch flue.

For a flue 8x8 inches, six bricks will be necessary for each course or 30 bricks for one foot in height.

For a 8x12 inch flue, seven bricks will be necessary for each course, or 35 bricks for one foot in height.

For a 12x12 inch flue, eight bricks will be necessary or 40 bricks for one foot in height of chimney.

By remembering the size of bricks to be used, with the aid of a cross section of the chimney shown by Fig. 54, no matter if it has one, two or three flues, the above method of figuring the number of brick needed can be used. The method consists in finding the number of brick necessary to enclose the area desired and then multiplying by five to get the number of brick for one foot of height in chimney. Table VIII shows the number of brick required in different size chimneys.

For example, suppose it is desired to find the number of brick needed for a plain chimney 25 feet in height, having one 8x8 and one 12x8 flue. It will require eleven bricks for each course or 55 to one foot in height of chimney and 1,375 for 25 feet in height.

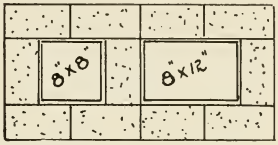


Fig. 54—Shows number of brick in chimney with 8x8 and 12x8 flue.

Fig. 54 shows number of brick in section of chimney. Another very simple method of figuring single flues is to find the number of cubic feet in the chimney by multiplying the area (in square feet) of cross section of the chimney considered as solid, by the height in feet and subtract the contents of the flues indicated as follows:

For an 8x8 flue, subtract one-half of the length of the flue in feet.

Table No. VIII

Number of brick in chimney

Hgt.	1 Flue 8x8	1 Flue 8x12	1 Flue 12x12	2 Flues 8x8	1 Flue 8x8 1 Flue 8x12	2 Flues 12x12	1 Flue 12x12 1 Flue 12x16
12.....	360	420	480	600	660	812	870
14.....	408	476	544	680	748	952	1020
16.....	462	539	616	770	847	1078	1155
18.....	522	609	696	870	957	1218	1305
20.....	576	672	768	960	1056	1344	1440
22.....	636	742	848	1060	1166	1468	1590
24.....	696	812	928	1160	1276	1624	1740
26.....	750	875	1000	1250	1375	1750	1875
28.....	810	945	1080	1350	1485	1890	2025
30.....	864	1008	1152	1440	1584	2016	2160
32.....	924	1078	1232	1540	1694	2156	2310
34.....	984	1148	1312	1640	1804	2296	2460
36.....	1038	1211	1384	1730	1903	2422	2595

For the 8x12 inch flue, subtract 2/3 of the length of the flue in feet.

For a 12x12 inch flue, subtract the length of the flue in feet.

Two flue chimneys built with tile need no center partitions. therefore, from 1½ to 2½ bricks on a course will be saved.

8x8 square flue lining tile costs about 18c per lineal foot.

8x12 flue lining tile costs about 27c per lineal foot.

12x12 square flue lining tile costs about 35c per lineal foot, and 12x16 flue lining costs 53c per lineal foot.

Fire clay stove thimbles may be obtained in sizes varying from 4 to 12 inches in diameter and from 4½ to 12 inches in length. These stove thimbles are constructed about ¼ inch larger than sizes given to receive stove pipe.

It is hard to estimate the exact amount of brick it will take to a lineal foot of fireplace chimney, as it will vary according to the size and construction. It will average from 80 to 120 per lineal feet.

The builder should take care to see that the chimneys are built according to the size specified. On our blueprints we suggest location and size of chimneys, but they can be changed if desired. The flues should be carried straight up and independent of one another and uniform without, with proper thimble and stoppers put in where required.

The witches or partitions in chimneys should be four inches thick and bonded to the sides of the chimney and extended in every case to the top.

The flue for the furnace or heating apparatus should be carried from cellar to top of chimney independent of all other flues.

Be sure the chimney is constructed of good hard, sound, burned, common bricks and laid in lime mortar. Where chimney shows on outside wall of building it should be faced with a good grade of sand mold brick of even color and neatly pointed.

The mortar used for chimney should be made of best lime one part, and clean sharp sand two parts and the top courses laid up in cement mortar composed of Portland cement one part, clean sharp sand two parts. Too much water must not be used in mixing, and only mortar as is required for immediate use mixed at one time. None that has stood over night should be used. See that the mortar is made thin enough so it will spread, but not run.

Chimney brick should be laid so that there are no straight joints and each layer of brick be well leveled.

Except in freezing weather, the brick should always be wet down with a hose before being layed into the chimney, as this will prevent them from taking up all of the moisture in the mortar. If the moisture is drawn out by dry, porous brick, it will not set properly. If necessary to build your chimney in freezing weather, it is always advisable to heat your material by the use of Salamanders.

The footings under the chimney should be from 4 to 6 inches larger than the base of the chimney, and from 8 to 12 inches deep. (See paragraphs on footings.)

In smaller summer houses and cheap dwelling houses, tile chimneys are often used. A bracket is constructed as shown by Fig. 53 and the tile placed on top of it, extending up thru the roof. The tile for chimneys costs 85c each for the top and bottom, and 50c each for the straight lengths. A top and bottom and from 1 to 3 straight lengths are necessary to construct a chimney. The joints can be made tight with a little fire clay which will cost about $1.00 per hundred pounds.

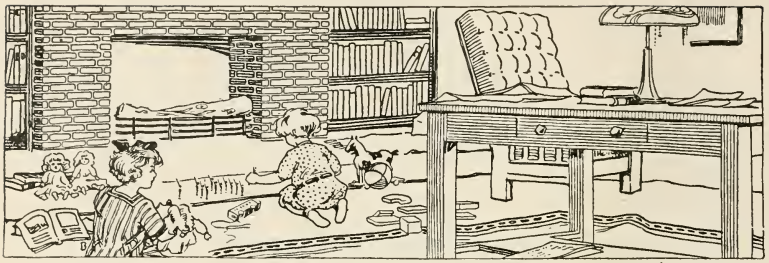
The building should be framed so that there is about a 1½ inch space between the frame and the chimney. Some building codes require more.

The Fireplace Crane

The lights are out, and gone are all the guests
That thronging came with merriment and jest
To celebrate the Hanging of the Crane
In the new house,—into the night are gone,
But still the fire upon the hearth burns on,
And I alone remain.

O fortunate, O happy day,
When a new household finds its place
Among the myriad homes of earth,
Like a new star just sprung to birth,
And rolled on its harmonious way
Into the boundless realms of space!
So said the guests in speech and song,
As in the chimney, burning bright,
We hung the iron Crane to-night,
And merry was the feast and long
from "The Hanging of the Crane."

—*Longfellow*



Fireplaces

FIREPLACE oddities are as fascinating to-day as of long ago when the fireplace was the most attractive part of the home. Never since the Colonial days of this country has the wood burning fireplace been so popular as to-day. It has again come into its proper place in relation to our home and has come to stay. We say this with confidence and with sincerity, because there is nothing that can give that particular touch of coziness, comfort and cheer which a few sticks or logs blazing on the hearth can give. The artificial gas log does not give it, and certainly a steam or water-radiator does not give it, but the hearth fire is a magnet which draws and charms one irresistibly and creates that atmosphere of comfort and cheer, which makes the distinction between a house and a home.

Man's original use of the fireplace in the camp or good fire will forever remain, as it is the most practical of all forms in its gathering together with all great force of nature for comfort and pleasure. Like the thing of beauty which it is, and to be a joy forever, the fireplace must be honest, genuine, built for use and capable of burning without smoking, that is, the smoke must be directed into the flue and not in the room.

What is home without a fireplace? Everyone loves the open fire, as there is something fascinating and pleasant about one that is lacking in any other system of heating. The fact is that to-day it is the most predominating form of heating in European countries, and in our own country, is a strong argument in its favor. Not only must it be built for comfort, but made a spot of beauty as well. It is not necessary to sacrifice the beauty of the fireplace and mantel in order to obtain an efficient one.

A coal grate is perhaps the best substitute for a wood fire, but lacks much of the charm of blaze. Oak or hickory stick and also wood have the advantage that they can be kindled and blazing in two or three minutes and allowed to die out and rekindled at will. As a ventilator and circulator of air in the house, the fireplace has no equal, as it is constantly changing the air in the room and drawing in a fresh supply. Where the house is heated by a warm air furnace or indirect radiation, the fireplace assists the heater by withdrawing the lower and cooler strata of air from the room and drawing down the warm air which immediately rises to the ceiling, equalizing the temperature to a large extent. A room in which there is a fireplace will never become stuffy.

The most prominent place in a home for the fireplace is either in the

living room or dining room, but they are also of great advantage in bedrooms, especially in case of sickness.

In the Spring and Fall months, there are many days when it is not necessary to have the heater going, as a small fire in the fireplace will make the house comfortable.

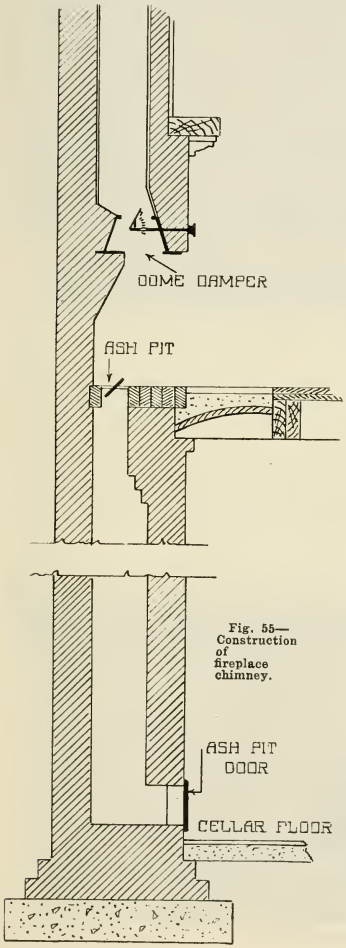


Fig. 55—Construction of fireplace chimney.

We believe in brick for the construction of the fireplace, as burned clay is the material par excellence for this work, it being fire-resisting and therefore perfectly adapted for this purpose and also thoroughly artistic. Fire brick or ordinary hard-burned common brick are suitable for lining the fireplace, but on the other hand, stone with the exception of soap stone will chip and disintegrate under heat, and iron linings will warp and check.

However, the faults of fireplaces are very common and everyone is familiar with them to some extent. The worst of these is a smoky fireplace. In most cases this is caused by the flue not being large or high enough. Even a poorly constructed fireplace will not smoke if the chimney is an exceptionally good one.

There are doubtless many who at this season of the year turn to their fireplace for comfort and are disappointed as volumes of smoke enter the room instead of taking the course intended by the builder, who, however, has carefully constructed the fireplace in full accordance with the ideas of the architect, the latter with rare taste and skill having designed the fireplace and mantel with elaborate architectural treatment.

To produce a fireplace, however, that is satisfactory in every respect, requires that the flue be properly proportioned to the opening according to certain rules and that the throat and smoke chamber be correctly fashioned. The depth of the fireplace should never be less than fifteen inches, preferably twenty inches and for large fireplaces twenty-four inches. A greater depth than this is unnecessary,

except for very large fireplaces. The opening should not have a height greater than two feet, six inches.

We will give certain rules and suggestions for the construction of fireplaces, which are the result of considerable actual experience along this line.

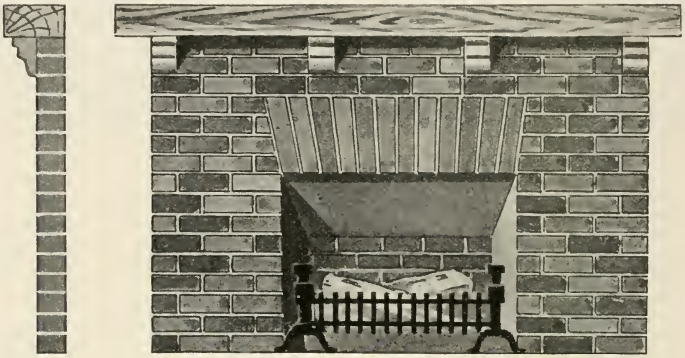


Fig. 56—Brick Fireplace.

One of the most important things is the shape. Splayed jambs or sides and sloping back have a tendency to direct the heat rays into the room and are much less stiff in appearance than those constructed with straight sides and plumb backs.

It is very difficult to estimate the exact size of flue needed for a given size fireplace, because there are so many facts to take into consideration, such as kind of flue, height of flue, whether inside or outside chimney, kinds of material used, and many other questions that need be considered.

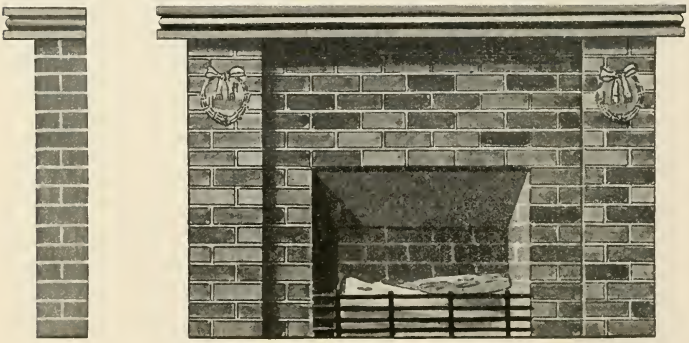


Fig. 57—Brick Fireplace.

It is a very wise plan to line fireplace flues with fire tile which will reduce friction and insure a smooth flue that will not clog. In some parts of the country, flue lining of tile is very expensive. In such cases, chimneys plastered up smoothly on the inside of the flue with a good cement plaster will answer the purpose.

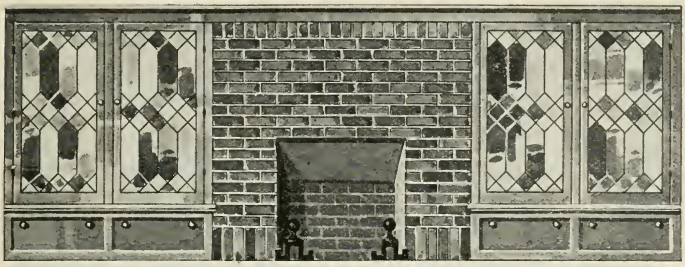


Fig. 58—Brick Fireplace with bookcase at sides.

When chimneys and fireplaces are properly constructed, the table below will give the size necessary for the different size openings needed.

Size of Opening.	Size of Flue.
24 inch	8x8
30 inch	8x12
36 inch	8x16
42 inch	12x12
48 inch	12x16

The construction of the chimney itself is not the only cause for a smoky fireplace. Refer to Fig. 55. You will notice the overhang of the fire brick in the back of the opening. We have found that many masons will construct the opening improperly, instead of giving the overhang a gradual slope, starting from the center of the opening, will break it off sharp at the top, holding the brick in place by the use of angle iron. This is a very poor method and invariably will not give the desired results.

The sloped back produces a narrow throat and gives a wind break on shelf back of it, which is the best device for stopping a down draft.

The throat, or that part of fireplace where it contracts just above the arch, is very important, for if it is not properly shaped, there will be trouble in the form of smoke working its way out into the room no matter how good a draft a fireplace may have.

The throat should be provided with a valve or damper to shut off down drafts and control ventilation. "Is a damper necessary in a fireplace?" This question has often been asked. Our experience has been that all flues are subject to down drafts at times, owing to atmospheric conditions, and at such times, the damper is a necessity. When the outside atmosphere is warmer than the inside, especially in the summer months when the fireplace will not be used, very often the air in the flue will drop, producing a down draft, and

admit particles of soot which will cause damage to carpets, rugs, floors, and furniture. There are many other causes for down drafts such as the rebounding of air currents from the sloping roof when the wind is from a certain direction, or a large tree overhanging the house.

In warm months when the windows are kept open, the ventilation of the

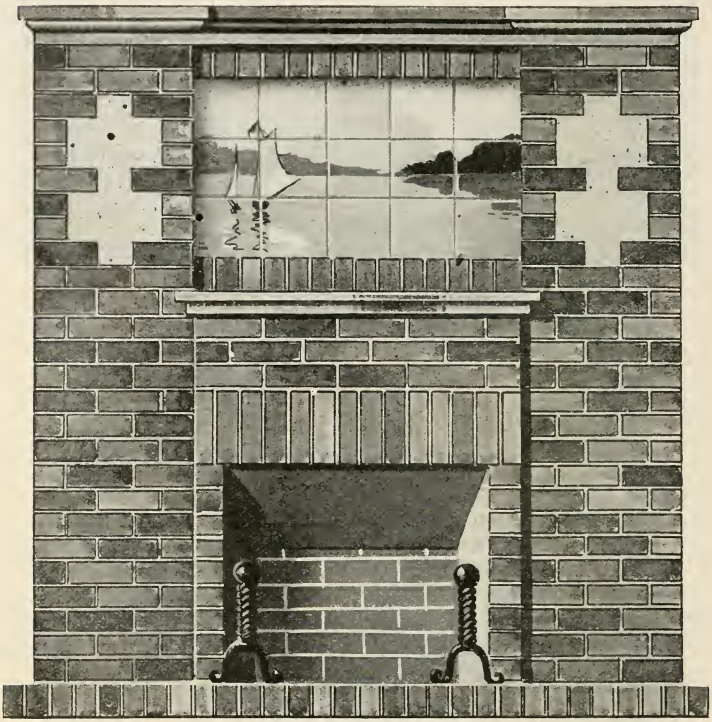


Fig. 59—Brick Fireplace.

fireplace is not required and the damper can be kept closed, shutting off the down drafts effectively. In the cold months, the down drafts are not likely to occur and the fireplace will provide the best of ventilation even if there is no fire in it.

The gradual slope of the back wall of the opening has a tendency to direct the heat out into the room and also concentrates the smoke, giving it a better draft up the flue. The back wall should also be carried well above the fireplace opening.

A fireplace should not be too deep, for a deep fireplace will not radiate

so much heat into the room as the one which is properly proportioned as to depth.

The following table will give the proper proportion of depth for the different width of opening:

Width of Openings.	Depth of Openings.
26 inches	16 inches
30 inches	18 inches
34 inches	20 inches
38 inches	22 inches
42 inches	23 inches
48 inches	24 inches

With the sides or covings of proper depth and proper angle to the back, the breast and throat of the required height in proportion to the width of the

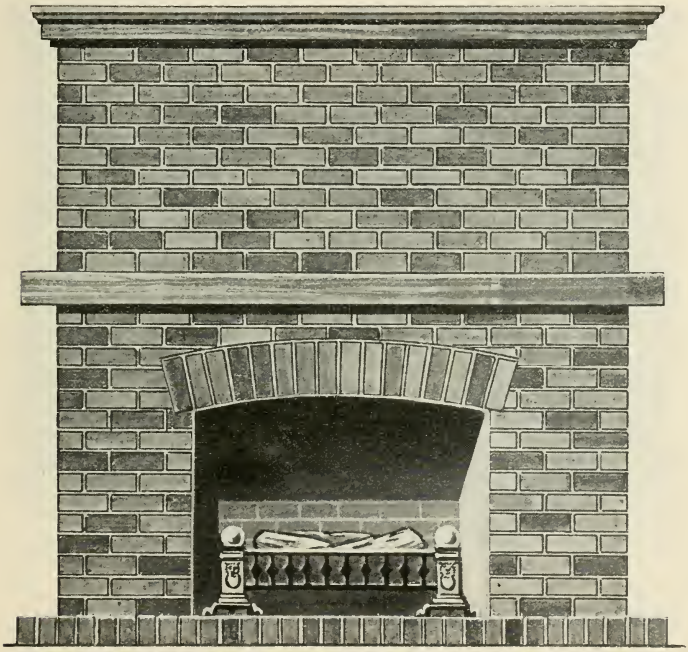


Fig. 60—Brick Fireplace.

opening in front, very surprising results are obtained and leave nothing whatever to be desired, especially when they are made of a material which will reflect rather than retain heat.

Of late a newly manufactured product has been put on the market which meets all the requirements for fireplace construction. This product is largely composed of asbestos and is made in large slabs which can be cut and molded in the necessary shapes. It is fire proof in every sense of the word, a perfect insulator and will not warp and get out of shape under most severe conditions. This material makes it possible for fireplaces to be manufactured and shipped in a knock-down condition.

The size of the footings upon which fireplace chimneys are to be built, will be governed by the size and height of the chimney. They should be made from 6 inches to 8 inches wider than the chimney itself, and about 10 inches deep if placed on good clay for an ordinary two-story dwelling house.

The bottom of the chimney is usually built hollow in order to form a receptacle for the ashes from the grate. An iron door is placed at the bottom of this opening in order to clean it out. This door is usually about 10x12 inches, just large enough to take a small shovel in cleaning.

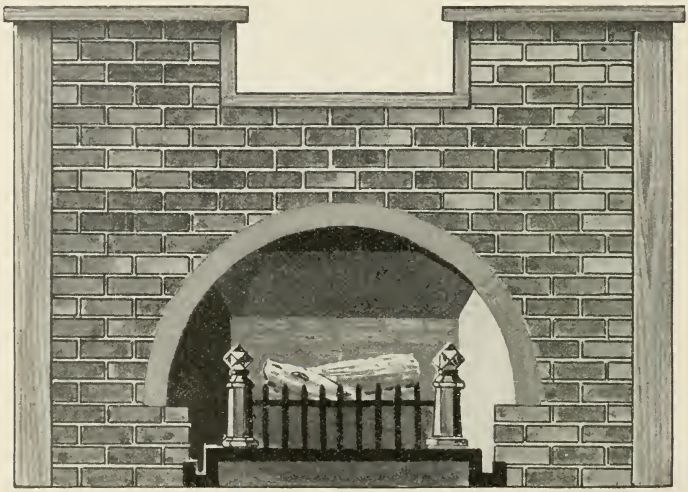


Fig. 61—Brick Fireplace.

In buildings where wooden frames are used, the hearth of the fireplace is usually supported by an arch which is constructed of wood or brick. The hearth of the fireplace is commonly 18 inches deep by the width of the chimney in length.

The smoke chamber should not be larger than necessary and drawn in at first toward the center of the chimney, otherwise, the fire will burn in a one-sided manner, then it can be drawn over to whatever side you wish the flue to pass up. The sides of the smoke chamber should be reasonably smooth and all square angles or shoulders avoided, reclining gradually in area until it connects with the flue.

If the metal or reinforced cement smoke chamber is not used, the sides should be well plastered with cement lime plaster.

There is much difference in opinion as to how wide the throat of a fireplace should be. The throats vary from four to eight inches, depending upon the size of the fireplace and the kind of fuel used.

To estimate the proper width of the throat is a difficult matter. Builders will use 4 inches as a general rule, but it will not be sufficient in all cases, it depending upon the fuel and the depth and height of the fireplace opening. Four inches is most always used, five inches is nearly always sufficient, while six or seven inches will meet all conditions.

Hints on Construction

It is a good plan to put in a damper so that the throat of the fireplace can be regulated and to prevent the loss of heat when the fireplace is not in use.

It is essential in a good fireplace, to have an air space in back of it, as this will prevent the loss of heat and will also keep the moisture out of the fire brick. Note air space in Fig. 55. Care must be taken that all dead air spaces are tightly closed up at top.

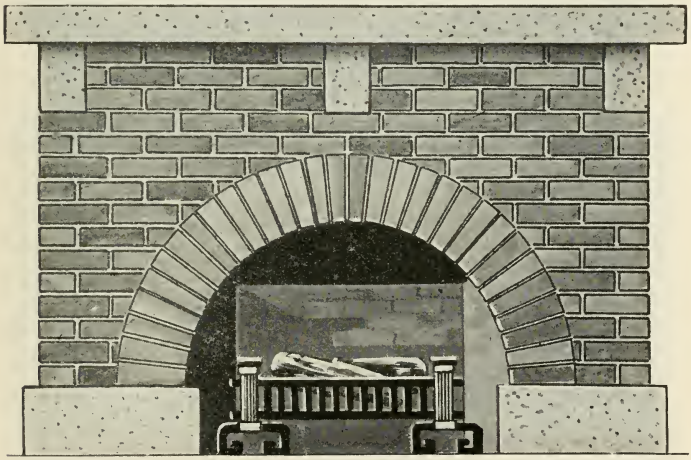


Fig. 62—Brick Fireplace.

It is a fact that heat will travel in a direct line, therefore, the slope which is given to the back and sides of the fireplace will have a tendency to radiate the heat into the room. The sides can be sloped about three or four inches to a foot.

Do not put a thimble in a fireplace flue. Be sure that the mason builds the chimney so that the mantel does not rest entirely on the trimmed arch. The chimney should be constructed so as to support it. See that the

overhanging back wall is built with fire bricks laid in flat, with as thin a joint as possible. Do not let an inexperienced man build your fireplace.

We have shown a number of fireplaces of different designs which may be suggestive to our builders.

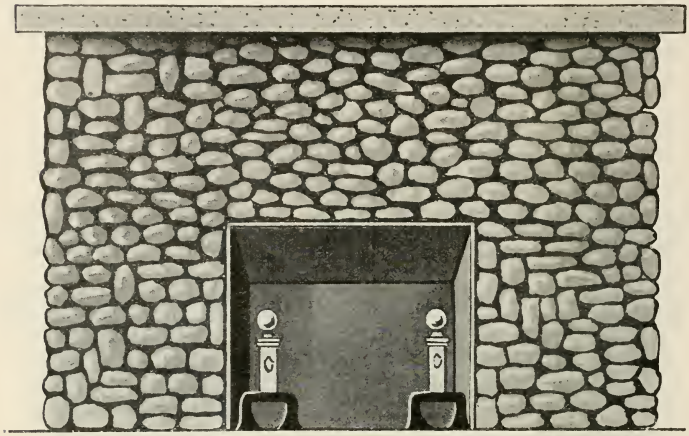


Fig. 63—Fireplace constructed of cobblestone.

Figs. 56 and 57 show fireplaces which have been constructed of cherry red brick with a heavy wood shelf and brackets. These fireplaces though plain, will give a very pleasing appearance.

Fig. 58 shows the elevation and construction of a Colonial design of fireplace with bookcases at sides. Fireplaces of this design will give the most pleasing appearance providing the colors used will harmonize. Dark red brick embedded in black cement plaster with the bookcases stained mahogany is one of the many color schemes which can be used.

Fig. 59 shows elevation and construction of a beautiful art mantel and fireplace, using a combination of cement plaster and paving brick capped with heavy wood shelf and brackets. A very harmonizing effect can be brought out in this mantel by coloring the cement plaster with mineral paint or pigment.

Fig. 60 thru Fig. 62 shows different methods in which brick can be used in an artistic manner in fireplace construction.

In Figs. 59 and 60 you will notice that the hearth is raised above the floor and is constructed of brick. Fig. 62 shows another design, in which stone has been artistically used in connection with brick.

Fig. 63 shows construction of cobble stone fireplace. Fireplaces constructed in this manner are much more expensive than those constructed of brick, but will give a very rustic and pleasing appearance when completed.

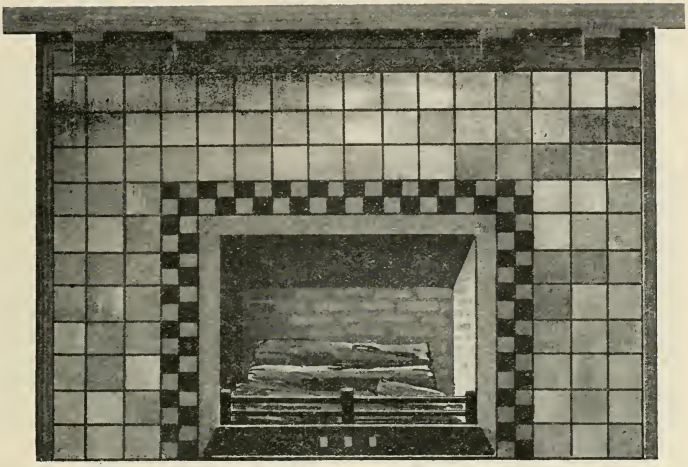


Fig. 64—Tile Fireplace.

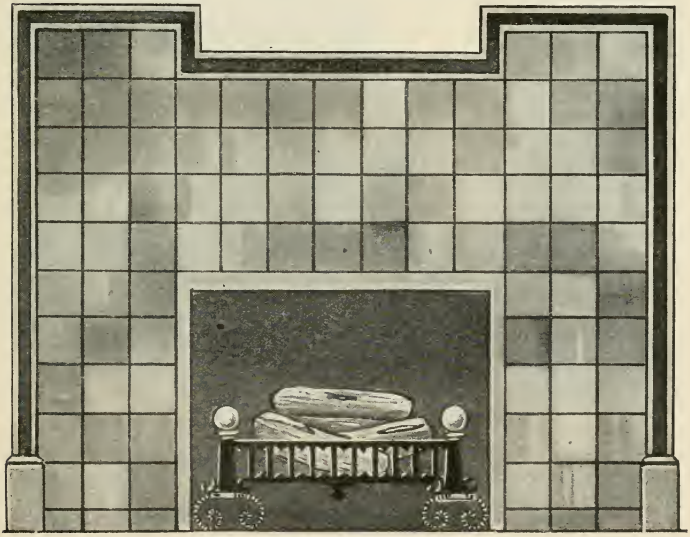


Fig. 65—Tile Fireplace.

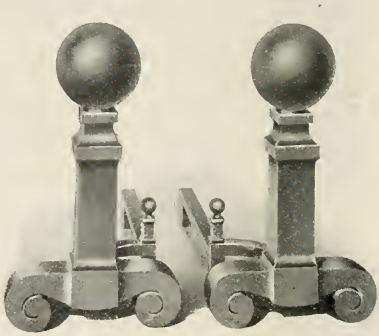
The main points that will have to be taken into consideration when building a fireplace out of cobble stone will be the character of the stones, the filling of the space between the stones, the mixing of the mortar and the pointing between the stones, of the exposed parts. Refer to paragraph on cobble stone.

Figs. 64 and 65 show fireplaces constructed of tile.

The fixtures of fireplaces add considerably to the appearance. The basket or grates in which the fire is kindled should be proportioned and harmonize in design with your fireplace. This basket is for the purpose of keeping the fire up off of the base of the fireplace. The grates in the baskets allow the ashes to pass thru and be discharged thru the automatic ash doors in the base of the fireplace.

Andirons add considerably to the appearance of the fireplace and they are manufactured in many shapes and forms, some of which are made to support the fireplace baskets, others are especially suitable for gas logs for burning wood without a fire basket.

A few designs of fireplace baskets and andirons are shown by Fig. 66. These fixtures should be selected so they will harmonize with the design of your fireplace and also be in keeping with the size of opening. Fireplaces should also be equipped with screens or guards



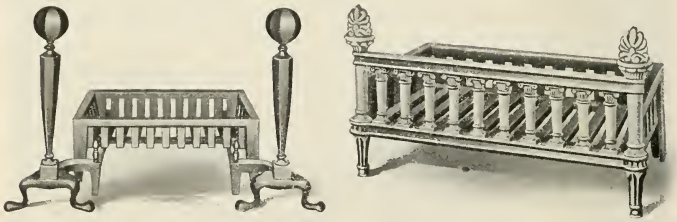


Fig. 66—Andirons and Baskets.

to be placed over the opening to prevent sparks from being drawn out into the room. Fig. 67 shows a common form of black or brass screen. Fig. 68 shows a more elaborate guard which can be folded up and laid away in a very small space. The screen, when properly selected, will add to the appearance of

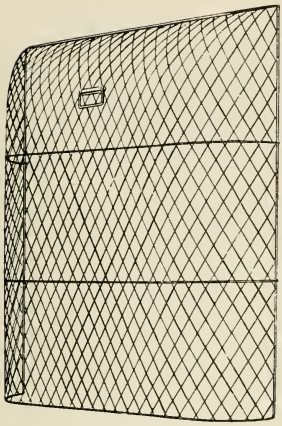


Fig. 67—Spark Screen.

fireplace, especially when it is not burning, as it will hide the unpleasant appearance of charred brick and ashes.

Fig. 69 shows a very handy firewood holder. This can be purchased at any furniture store.

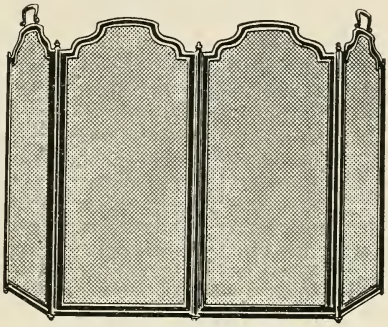


Fig. 68—Folding Spark Screen.

Fig. 70 shows fireplace set usually constructed out of brass or cast iron, each set consisting of small shovel, prongs and poker.

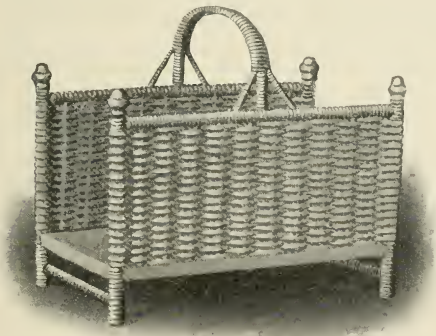


Fig. 69—Wicker Wood Holder.

Fig. 70—Fireplace Set.

Stucco

THE importance of stucco construction is fast becoming prominent among the different home builders of the country. Undoubtedly, the reason for this large measure of popularity lies in its wide range of uses. This material is fast becoming one of the most generally utilized products for domestic architecture.

A few designs in our catalog have been shown finished with stucco walls which give a very pleasing appearance. But stucco can be used to advantage in many different ways in beautifying the home.

Today we see many homes erected with a stucco exterior. It might be added that some of these and a goodly percentage, are lacking in the very essential for which we were originally striving, the attractive exterior. This is due to several things. In the first place the style of the house might be such as to make the exterior inharmonious. The lines and angles are out of proportion and the setting lacking in important respects. The exterior is devoid of proper color effect and the material sometimes of poor quality, not properly applied, gives the structure a hideous appearance.

To make the stucco exterior home of real attractiveness and to make it durable, we cannot afford to use inferior materials. The logic of this is so plain as to need no comment. Then, with good material in the hands of careless workmen, there will be an unsatisfactory job and the house will be, to the owner, what it is to the beholder—a miserable makeshift.

It might be added that with the use of the best stucco, the effects possible are wonderful and with the use of contrary kinds, there is nothing that will so mar the value and outward appearance of your home. Instances of this are common, and furthermore, there are to be seen vast cracks, even loose sections and sometimes large sections falling off. Many times these defects are laid to the foundation, or to the lath, by the man who has applied the stucco, and he thus seeks to hide his own inferior material, or lack of conscientious labor.

There was a time when we thought all walls, foundations, pedestals and chimneys must be constructed of brick or stone, but experience has taught us that very proper effects can be brought out by the use of stucco, whether the spirit of the house happens to be Spanish, French, English or any other of the many types commonly used.

Stucco is composed of the following material: Sand, wash gravel, lime, hair, water proofing compound and cement.

Specifications for stucco should be as follows:

The cement shall meet the requirements of the Standard specifications for Portland cement of the American Society for Testing Materials, and adopted by the American Concrete Institute. (Standard No. 1.)

Fine Aggregate shall consist of sand, crushed stone or gravel screenings, graded from fine to coarse, passing when dry, a screen having ⅛ inch diameter holes, shall be preferably of silicious materials, clean, coarse, free from loam, vegetable or other deleterious matter.

The lime shall be thoroughly hydrated either by the manufacturer, or the contractor. If hydrated by the contractor, it shall be slaked in sufficient water

to make a soft paste and allowed to stand at least one week before being applied to the wall.

There shall be used only first quality long cow hair, free from foreign matter, or long cocoanut fibre well combed out.

Only mineral colors shall be used, but no coloring matter which is affected by lime, Portland cement or the elements is permissible.

Water shall be clean, free from oil, acid, strong alkalies or vegetable matter.

SHEATHING—Sheathing boards shall not be less than six inches or more than eight inches wide, dressed on one or both sides to a uniform thickness of 7/8 inch. They shall be laid horizontally across the wall studs and fastened with two nails at each stud.

INSIDE WATERPROOFING—Over the sheathing boards shall be laid in horizontal layers, beginning at the bottom, a substantial paper well impregnated and thoroughly waterproofed with tar or asphalt. The bottom strip shall lap over the base board at the bottom of the wall and each strip shall lap the one below at least two inches. The paper shall lap the flashing at all openings. When required, the lower horizontal edge of each strip shall be cemented with hot or liquid tar or asphalt compound, to the strip below and to the grounds of flashings at all openings. All tacking shall be within two inches of the top horizontal edge, where tacks will be covered by the lap of the strip above.

FURRING—Sykes Expanded Cup Lath (furnished with ALADDIN houses) is self-furring. The mortar gets a perfect key when the lath is fastened directly to sheathing boards without the use of furring strips.

The first coat shall contain not more than two and one-half (2½) parts of sand to one (1) part of Portland cement by volume. If lime putty is added, it shall not be in excess of one-fifth (1/5) of the volume of cement. Hair or fibre may be added in sufficient quantity to bond the mortar.

For second coat, the proportion of sand to cement shall not be greater than 2½ to 1 by volume, nor shall more than 1/5 part of lime putty be added.

For third coat, if used, the proportion of sand to cement shall not be less than 2 to 1 nor more than 2½ to 1, by volume, nor shall more than 1/5 part of lime putty be added.

When a special waterproofing is to be added to mortar for stucco work, it shall be added in strict accordance with the specifications of the manufacturer. Lime should be omitted in the coat in which waterproofing may be used.

The plastering should be carried on continuously in one general direction, without allowing the plaster to dry at the edge. If it is impossible to work the full width of the wall at one time, the joint should be at some natural division of the surface, such as a window or door.

The first coat shall be applied to the outside of the lath and pushed thru sufficiently to give a good key. Over the face of the sheathing, the plaster should be forced well thru the lath in order to fill entirely the space between the lath and the sheathing. The backing coat shall be applied to the back of the lath and shall be thoroughly troweled so that the lath shall be entirely covered. The final coat shall be applied to the face of the first coat.

Soon after applying and before the initial set has taken place, the surface

of the coats which are to receive succeeding coats, shall be roughened with a saw-toothed paddle or other suitable device.

Before applying mortar the surface of the preceding coat shall be thoroughly wetted to prevent absorption of water from the fresh mortar. This can be done by keeping a pan of water and a large brush handy.

In applying, keep in mind the following:

The first coat should be applied of such a thickness that it will cover the metal lath or fabric and fill the crevices. As soon as this coat has hardened sufficiently, it should be scratched at right angles and at about 45 degrees to the horizontal.

The scratches used should not cut a sharp line in the plaster, but should form grooves with ridges on the sides, so as to present a rough surface for the following coat to adhere to.

The second, and all the following coats, should be applied after the preceding coat has hardened, but preferably before it has had time to dry out.

When placing stucco over a masonry surface, special care must be taken to thoroughly saturate the masonry with water, and the paste applied at once. When stucco is applied to dry masonry walls, the walls will take up mostly all the moisture that should stay in the stucco and this will have a tendency to reduce the strength of the same.

The water compound or waterproofing which is applied with the outside coat, renders the wall impervious to water, insuring greater durability and dry walls.

Do not apply stucco when there is any danger of the temperature falling below freezing and preparations should be made to prevent too rapid setting. In hot weather, it is often necessary to cover the wall in some manner to prevent the stucco from setting too rapidly which can be done by the use of a damp canvas, or burlap, and when sufficiently resistant, should be frequently sprinkled with water.

MIXING—The ingredients of the mortar shall be thoroughly mixed to a uniform color, sufficient water added to obtain the desired consistency, and the mixing shall continue until the cement and lime are uniformly distributed and the mass is uniform in color and homogeneous.

The hair or fibre shall be added during the process of wet mixing.

MEASURING PROPORTIONS—Methods of measurement of the proportions of the various ingredients, including the water, shall be used, which will secure separate uniform measurements at all times. All proportions stated are by volume. A barrel of cement shall be assumed to contain 3.8 cu. ft. Lime when used shall be measured in the form of putty. Hydrated lime shall be made into putty before being measured. A cubic foot of lime putty contains .31 cu. ft. of hydrated lime weighing 45 lbs. and .69 cubic feet of water weighs 43 lbs.

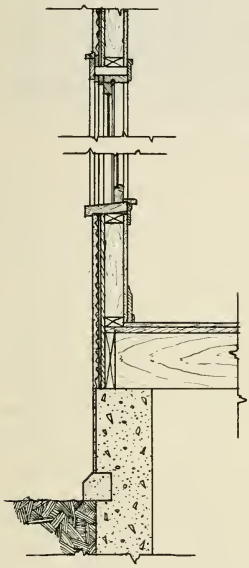
QUANTITY—There shall not be mixed at one time more mortar than will be used within one hour. Mortar which has begun to stiffen or take on its initial set shall not be used.

HAND MIXING—The mixing shall be done on a water-tight platform and the materials shall be turned until they are homogeneous in appearance and color.

CONSISTENCY—The materials shall be mixed so as to provide sufficient water to insure a proper bonding and a dense mortar free from voids.

RETEMPERING—Retempering mortar, i. e., remixing with water after it has partially set, shall not be allowed.

PREPARATION OF ORIGINAL SURFACE—All roof gutters shall be fixed and down-spout hangers and all other fixed supports and fasteners put up before the plastering is done, so there will be no break made in the plastering where they are permanently fixed.



Wall copings, balustrade rails, chimney caps, cornices, etc., shall be built of concrete, stone, tile or metal with ample over-hang drip grooves or lip, and water-tight joints, to keep water from behind the plaster.

If wood sills are used, they should project well from the face of the plaster and have ample drip, groove or lip.

Metal lath shall be stopped far enough above the level of the ground to be free from ground moisture.

Care should be taken to provide for placing all trim the proper distance from the sheathing to show its right projection after the plaster is on, that is, furring strips should be used behind window casing, etc. No exterior plastering should be permitted until all the interior framework has been finished and the building completely braced.

Many kinds of wood and metal lath are on the market to-day. Be sure to select a good grade for your building. Wood lath are often used for stucco work, but unless they have been treated to take care of shrinkage and warping, we would not advise using them to any extent unless they are first wet down so that they will not take up the moisture of the stucco. The lath should be furred out so that the stucco can form a "key"

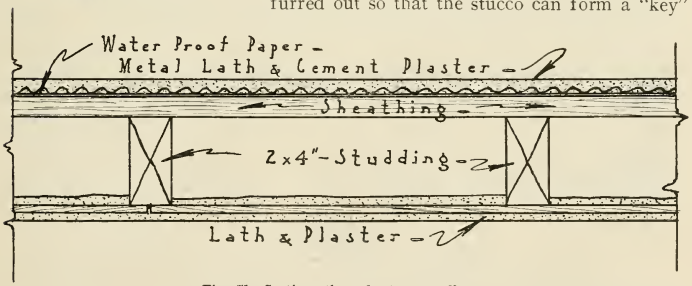


Fig. 71—Sections through stucco walls.

or clinch in back of them. Metal lath are usually made self-furring so that

they can be nailed over side walls without using furring strips. Figure 71 shows section of stucco wall.

The metal lath furnished with Aladdin houses when stucco is furnished for outside walls, is Sykes Expanded Cup Lath. It is self-furring and you get a perfect key when fastened directly to sheathing board or when passing over wood studding without the use of furring strips. Sykes metal lath is manufactured in sheets 18x96 in. and packed in bundles of 15 sheets each, containing 20 square yards. It is furnished in 27-, 26-, 24-gauge painted and galvanized metal.

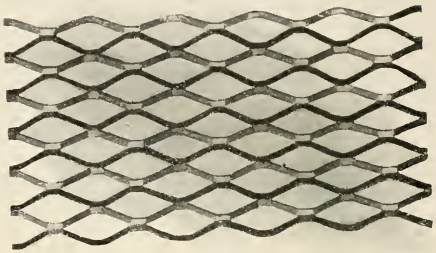


Fig. 75—Expansion Metal Lath.

The sheets of reinforcement or metal lath should be placed horizontally, that is, rib material should have the ribs run across the studding. The expanded metal should be placed with the long dimension of the mesh horizontal. In expanded metal, the dip should be inward and downward away from the workman, so that a perfect "key" can be formed.

Grounds should allow at least ⅜ inch over face of sheathing. Edges of sheets should lap about the width of mesh and no more, simply to make the sheets stiff, and the meshes should nest. For best results, metal weighing not less than three pounds per square yard should be used. If a vertical corner bead is not used, there should be six inch strips of metal lath bent around the corners and stapled over the side of lathing, or the sheets of side lath as applied, can be bent around the corners and fastened. A combination of corner bead and strip of lath is often recommended.

The lath should be fastened to sheathing with ⅞x14-gauge staples and nailed about 6 inches apart, into the studding as much as possible. The sheets of Sykes metal lath should be locked or lapped at least 1 inch and tied at joints between studs vertically and horizontally with 18-gauge wire.

In mixing, the cement and hydrated lime should be thoroughly mixed together first in a dry state until of a uniform color. Then add this to the dry sand and the whole manipulated until evenly mixed. The dry mixture should then be tempered to the correct oozing consistency, with water to which waterproofing has been added. The mortar is now to be thoroughly worked and mixed together until uniform. Make this mixture up in lots that can be immediately applied and any material that has been mixed with water over 30 minutes before applying, is not to be used.

Finishes

SMOOTH TROWELED—The finishing coat shall be troweled smooth with a metal trowel with as little rubbing as possible.

STIPPLED—The finishing coat shall be troweled smooth with a metal

trowel with as little rubbing as possible, and then shall be lightly patted with a brush of broom straw to give an even, stippled surface.

SAND FLOATED—The finishing coat, after being brought to a smooth, even surface, shall be rubbed with a circular motion of a wood float, with the addition of a little sand to slightly roughen the surface. This floating shall be done when the mortar has partially set.

SAND SPRAYED—After the finishing coat has been brought to an even surface, it shall be sprayed by means of a wide, long fibre brush—a whisk broom does very well—dipped into a creamy mixture of equal parts of cement and sand, mixed fresh every 30 minutes and kept well stirred in the bucket by means of the whisk broom or a paddle. This coating shall be thrown forcibly against the surface to be finished. This treatment shall be applied while the finishing coat is still moist and before it has attained its final set, i. e., within 3 to 5 hours. To obtain lighter shades, add hydrated lime of 5 to 15 per cent. of the volume of the cement.

SPLATTER DASH OR ROUGH CAST—After the finishing coat has been brought to a smooth, even surface and before attaining final set, it shall be uniformly coated with a mixture of one part cement and two parts of sand thrown forcibly against it to produce a rough surface of uniform texture when viewed from a distance of 20 feet. Special care shall be taken to prevent the rapid drying out of this finish.

PEBBLE DASH—After the finishing coat has been brought to a smooth, even surface, and before attaining initial set, clean round pebbles or other material as selected, not smaller than ¼ in. or larger than ¾ in., previously wetted, shall be thrown forcibly against the mortar so as to imbed themselves in the fresh mortar. They shall be distributed uniformly over the surface of the final coat and may be pushed back into the mortar with a clean wood trowel, but no rubbing of the surface shall be done after the pebbles are imbedded.

EXPOSED AGGREGATES—The finishing coat shall be composed of an approved, selected coarse sand, marble dust, granite dust or other special material, in the proportion given for finishing coats and within 24 hours after being applied and troweled to an even surface, shall be scrubbed with a stiff brush and water. In case the cement is too hard, a solution of one part hydrochloric acid in four parts of water by volume can be used in place of water. After the aggregate particles have been uniformly exposed by scrubbing, care shall be taken to remove all traces of the acid by spraying with a hose.

MORTAR COLORS—When it is required that any of the above finishes shall be made with colored mortar, not more than 6 per cent. of the weight of Portland cement shall be added to the mortar in the form of finely ground coloring matter.

A predetermined weight of color shall be added dry to each batch of dry fine aggregate before the cement is added. The color and fine aggregate shall be mixed together and then the cement and lime mixed in. The whole shall then be thoroughly mixed dry by shoveling from one pile to another thru a ¼ inch mesh wire screen until the entire batch is of uniform color. Water shall then be added to bring the mortar to a proper plastering consistency.

Many beautiful color effects can be obtained on walls, chimneys, or piers, with stucco, some of them by applying cement paint to the completed walls

and others by mixing coloring to the materials. Vegetable or oil color weakens the cement, while colors containing acid act upon the alkalis.

Nothing but mineral colors are suitable.

The following table will give the proportion and kinds of minerals used for coloring stucco:

Color.	Mineral.	Pounds of Color Barrel Cement.
Gray	Lamp Black	2
Black	Manganese Dioxide	48
Blue	Ultramarine	20
Green	Ultramarine Green	24
Red	Pompeiian or English Red	24
Bright Red	Iron Oxide	24
Sand Stone	Red Purple Iron Oxide	24
Violet	Violet Iron Oxide	24
Brown	Brown Ochre or Roasted Oxide	24
Yellow or Buff	Yellow Ochre	24

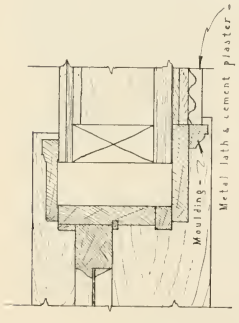
Overcoating

During recent years there has come into vogue a method of remodeling old frame houses. This "overcoating," as it is called, is used extensively in all sections of the country and the following practice is recommended:

Every house has its own defects and characteristics and each must be treated according to its physical condition.

A tight roof is essential.

Sometimes in this class of work, it becomes necessary to make some provision for extending the old window and door frames to correspond with in-



– SECTION BB –

Fig. 72.

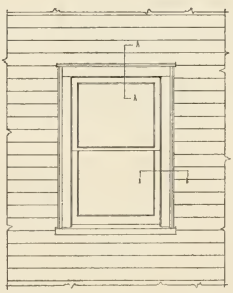
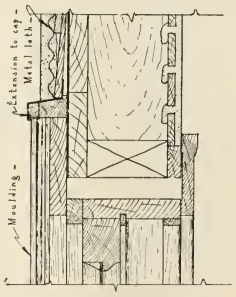


Fig. 73.



– SECTION AA –

Fig. 74.

creased thickness of the wall. In some cases the plaster is brought over the old frames in such a manner that a recess window or door opening is made. Another manner of taking care of the extra thickness of wall is shown in Figures 72, 73 and 74.

If the weather-boarding is in poor condition it should be removed and metal lath applied over the sheathing, to which waterproof paper has previously been fastened.

Another method would be to fasten the metal lath to the weather-boards, after applying waterproof paper over the weather-boarding.

In preparation for any of these methods the house should be gone over carefully to determine if the framework is well enough preserved to justify the improvement.

The doors should be looked after, the studding inspected, partitions and outside walls lined up and brought into plumb.

The area over which a barrel of Portland cement in various mixtures will cover with coating of various thicknesses is shown as follows:

TABLE IX.

Proportion.	Thickness of Coat.	Square Feet.
1 cement 1	inch	67
1 sand .....¾	inch	90
	½ inch	134
	¼ inch	268
1 cement 1	inch	104
2 sand .....¾	inch	129
	½ inch	209
	¼ inch	418
1 cement 1	inch	140
3 sand .....¾	inch	184
	½ inch	280
	¼ inch	560

Cost of Stucco

At the present writing, building materials are considerably higher than in former years. An estimate on stucco can be worked out from the present prevailing prices and the cost of labor in your community.

Metal lath will cost from 25c to 40c per yard, depending upon the gauge used (24-, 25-, 26-, 27-gauge).

Cement at (3.8 cu. ft.) at $2.40 per bbl.

Sand at $2.00 per yard.

Fine Gravel (for pebble dash) at $3.50 per yard.

Lime (hydrated) at $15.00 per ton.

Hair at 50c per bushel.

Keene's Cement

WHERE it is desired to finish plastered walls, ceiling, etc., with a very hard and highly polished surface, Keene's cement is generally used. This cement has been in use for a period of seventy years and is now recognized as an indispensable material for interior finishing. It is made in four grades.

"Regular," which is the grade used for all general plastering and finishing purposes.

"Fine" is made from specially selected hard polished rock to insure purity of color and is ground a little finer than the regular. It is used for castings, running mouldings, finishing columns and other ornamental plastering.

The "Coarse" grade is a very slow setting, coarsely ground material, used for backing up artificial marble.

The "Superfine" grade is used for facing artificial marble. It is slow setting, exceptionally fine ground, pure white and has a high tensile strength. There are no universally recognized standards for Keene's cement. Each manufacturer makes his own. The time of setting and fineness of grinding are occasionally varied to suit the conditions under which the material is to be used. Tensile strength in the "Regular," "Fine," "Coarse," "Superfine," per square inch seven days in air, 350, 400, 500, 550.

With the exception of lime, practically all plastering materials for interior use may be broadly divided into two classes, both having their origin in Gypsum rock—namely, hard wall plasters and Keene's Cement.

In the manufacture of hard wall plaster, the Gypsum rock is first ground, then calcined for a short period at a low temperature, forming a very quick-setting material known as plaster of paris. To this are added chemicals to retard the set, also hair, fibre or such other ingredients as may be necessary.

With Keene's Cement the process is entirely different. At no state of the manufacture does Keene's Cement resemble in any manner plaster of paris, and no free chemicals or retarders enter into its composition. In the hands of experienced workmen, the material goes through the various processes necessary to produce Keene's Cement, and it is packed in a pure form without the addition of hair, fibre or any other materials. From the moment the rock enters the mill, until the finished product pours into the sacks ready for shipment, the process differs at every point from the method of manufacturing other plastering materials.

Keene's Cement contains no retarder; can be retempered as often as necessary; is comparatively slow-setting, and is very hard and strong, without being brittle. It can be worked over thoroughly until all marks of joinings or other inequalities are removed; and as it can be retempered, there is no danger of "dead" plaster being applied to the walls, thus doing away with a fruitful source of future trouble.

The hard, close grained surface of a wall plastered with Keene's Cement forms an ideal base for painting or enameling. The expense of sizing is unnecessary, and the work can be started within a few days after the plastering is completed, thus dispensing with the usual delay. The most delicate colors may be safely applied, as there is no free alkali in Keene's Cement.

Keene's Cement is occasionally regarded as merely a superior variety of retarded hard plaster, whereas it is the direct opposite of this. It is the absence of unsanitary retarders, and the close, firm, germ-proof texture of the plaster that have been responsible for the use of this material in so many large hospitals, schools and other buildings where sanitation plays such an important part.

We do not recommend the use of Keene's Cement of any brand for exterior purposes. While it will stand very much more moisture than any other interior plastering material, it is not hydraulic, and will in time wear away when exposed to severe weather conditions.

Properly applied, Keene's Cement is permanent. It not only sets slowly, but hardens slowly, and a wall plastered with it grows stronger and more durable the longer it stands.

Keene's Cement does not deteriorate with age, as do ordinary plasters. If stored in a dry warehouse, it actually improves with keeping.

Named after the discoverer of the process, Keene's Cement has for nearly three-quarters of a century been the acknowledged standard in high-class plastering materials.

Wainscoting in Bathrooms, Kitchens and Corridors

To secure absolute sanitation, the base and cap moulds should first be run in Keene's Cement "Fine," and the space between filled in as in ordinary plastering. It is customary to run the cap mould about 4 feet 6 inches from the floor.

As the wainscoting is the part of the wall most likely to sustain injury from rough usage, it should be as strong as possible, and very little, if any, lime should be used in the finish coat.

When laying off wainscots in imitation of tiling, the finish should be sufficiently hard for the marking tool to cut sharply defined lines without tearing the wall. In the absence of a proper tool, the handle end of a file will usually give satisfactory results. As a general rule it is well to wait for twelve or fourteen hours after the plastering is completed before using the marking tool.

Another method is to allow the finish coat to dry out thoroughly, then mark it off into blocks of the required size with a blue pencil, such as carpenters use, making the lines about one-eighth of an inch wide. The work is then finished with two or three coats of a good transparent varnish.

While the above methods are often followed, a more pleasing and durable effect is obtained by leaving the finish in a smooth state, and not marking it off to reproduce tiling. A Keene's Cement wall is good enough to stand on its own merits, without being made in imitation of a less satisfactory material.

Keene's Cement is not waterproof. It will stand more moisture than any other interior plastering material, but where it is desired to wash the walls or wainscoting frequently, the same should be either enameled or given some other surface treatment.

Painting Keene's Cement Walls

If it is desired to give the plastering a decorative or waterproofing treatment, Keene's Cement will be found to possess many advantages over ordinary plasters for this purpose.

A Keene's Cement wall can and should be painted or enameled as soon as it is thoroughly dry; thus dispensing with the usual delay.

Keene's Cement makes a compact, close-grained surface that forms an ideal base for any kind of decorative work.

There is no free alkali in Keene's Cement, and the most delicate colors may be safely applied over it.

If it is desired to size the walls before painting, a primer of varnish, thinned down, will be found satisfactory.

Enameling Keene's Cement Walls

There are many excellent makes of enamel now on the market which are most suitable for use over Keene's Cement, and the manufacturers of such products will gladly furnish on request full directions for the use of their enamels in connection with Keene's Cement.

In general, however, it is safe to say that at least three undercoats should be used, preferably of white lead in oil, although it is quite customary to combine with the lead a certain preparation of zinc, increasing the amount of zinc used with each successive coat.

Undercoats should be allowed sufficient time to dry out thoroughly, and then be lightly sanded with sand paper. If the undercoats have been properly applied and finished, one finishing coat of white enamel should be sufficient.

Keene's Cement Blackboards

The strength and durability of Keene's cement makes it particularly suitable for blackboards in schools and lecture rooms, where it is not desired to go to the expense of installing slate blackboards.

When used for this purpose, the base coats should be applied as in ordinary plastering; the brown coat being brought to a true and level surface.

The finish coat should be composed of pure Keene's Cement and water, with the addition of sufficient lamp black to make the coat dark gray in color. This finish coat should not be less than one-eighth inch thick and should be troweled until perfectly smooth and level.

When dry, the finish coat should be painted with one of the preparations that are made and sold for this purpose, or instead, it may be given three coats of the following mixture: Dissolve one pound of white shellac in one gallon of wood alcohol, and add four ounces of lamp black and eight ounces of powdered pumice stone. This produces a surface to which chalk will readily adhere, and one that can be easily cleaned.

Cost of Using Keene's Cement

So many factors enter into the cost of finished plastering that it is not practicable to name prices that would apply equally over any large part of the country. The cost of materials and labor in the local market, and the state of business, will frequently cause marked variations in plastering estimates.

As a general rule, three coat work done with Keene's Cement will cost about 5c a square yard more than hard wall plaster. This estimate applies generally throughout the Central states. In the Pacific and Atlantic coast

states it would be better to figure about 8c per square yard more for Keene's Cement than for hard wall plaster.

Ornamental plastering executed in Keene's Cement is usually figured at about 10c per square yard more than when ordinary casting plaster is used.

In using Keene's Cement for wainscots, very little, if any lime should be used in the finish coat, which can either be left smooth or marked off in imitation of tiling. The total cost of this class of work, including enameling, will usually run about 90c per square yard, with an additional 10c a running foot for cap and base mouldings. This is only a fraction of the cost of tiling, and it eliminates the cost of repairs, which are so frequently necessary when tiles are used.

Important

Do not try to trowel a Keene's Cement finish as soon as it is applied. Let it stand for a few minutes—then trowel to a hard smooth finish.

Do not throw a Keene's Cement mixture away because it starts to SET either in the box or on the board. Add more water and retemper. You can't kill Keene's Cement.

Sanitary Floors for Bathroom and Kitchen

Many materials are being manufactured today to make permanent sanitary floors for kitchens and bathrooms of dwelling houses. Some of those most commonly used are tile, mosaic tile, asbestone, marbleoid, and many others.

Tile

THIS material is made of vitreous clay. It is made in regular tile forms of square and hexagonal shapes and of many shades of pink, blue, green, black, white and gray, which can be laid into very pretty designs for floors of bathrooms, kitchens, vestibules, stores, etc.

It is practically indestructible, very easily laid, will last a lifetime and is not only the best, but the cheapest floor you can buy. It is very easily cleaned, and therefore very sanitary. The even and regular texture of tile admits the adaption of Damask designs which have become identified and associated with this material. The minuteness of the tile admits a great variation of design and can, therefore, follow each line in architecture. It is also absolutely impervious to any acid or the elements to which it is exposed.

A few designs have been shown by Fig. 76 which will give a general idea of the pleasing effect that this tile will give to a room.

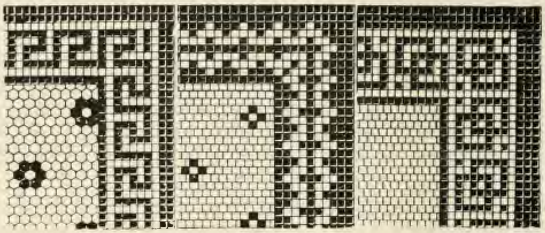


Fig. 76—Tile designs.

The tile is laid in a very easy manner. In the rooms where it is to be used, it will be necessary to notch out the joists so as to lower the wood floor about 2½ or 3 inches below the main floor. This will allow for a bed of concrete upon which the tile should be laid. Fig. 80 shows the way joists should be constructed to support concrete bed for tile.

A good foundation is always necessary and should be solid and perfectly level, free from spring or vibration.

Tile must always be laid upon a concrete foundation prepared of the best quality of Portland cement and clean, sharp, crushed level sand and gravel. Cinders should never be used as they tend to destroy the life of the cement, but if used, all ashes removed and the vitrified cinders and chunks thoroughly washed. The sulphur in cinders will destroy reinforcing in concrete.

Before laying the floor, the concrete should be allowed to thoroughly harden. Brush it well to remove all dust, and soak good with water. First, dust on concrete a thin coat of fine Portland cement before applying mortar for laying tile. Concrete should be allowed to stand more than three or four days before laying tile. Never mix lime mortar with the concrete.

Concrete should consist of one part Portland cement, two parts clean, washed, sharp sand and four parts gravel. Mix cement and sand thoroughly dry, add gravel and mix, adding sufficient water to form a medium mixture. Tamp concrete well around joists. Sometimes it is a good plan to use reinforcements of metal lath or wire.

The bed should not be less than 2½ or 3 inches thick. Surface of concrete must be level and finished within one inch of finish floor line (when tile ½ inch thick is used) which will leave a space of ½ inch for cement mortar.

Next comes the floats consisting of one part cement and two parts clean, sharp, washed sand into which the tile is to be embedded.

Semi-vitreous or vitreous tiles for floors are first laid out to ascertain if they are all right and compared with plan provided for laying floor. Strips are then set, beginning at one end and at the center of the room, and level with intended finished floor line. Two sets of floor guide strips running parallel about 18 to 30 inches apart should be set first. See Fig. 77. Mortar is then spread between them for 6 to 8 feet at a time, and leveled with a screed notch at each end to allow for thickness of tiles. See Fig. 78. Tiles are placed upon mortar which must be stiff enough not to work up between the joint. Tiles are properly pressed into mortar and tamped down with block and hammer until exactly level with strips. When space between strips is completed, strips on one side of tile are moved out 18 to 30 inches and placed in proper position for laying another section of tile, using tile which has been laid as guide for one end of screed and laying of tile continued in the same manner until the floor is finished.

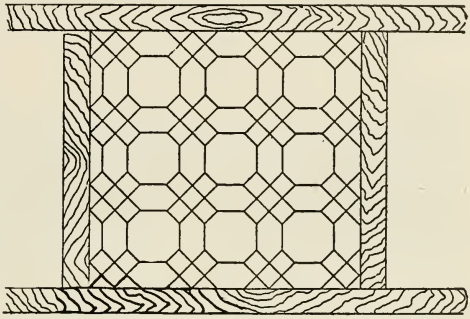


Fig. 77—Method of laying guide strips for laying tile.

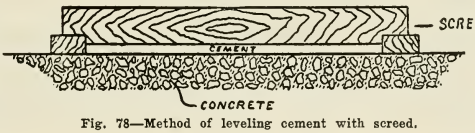


Fig. 78—Method of leveling cement with screed.

When cement is sufficiently set, which should be in about two days, see that floor is well scrubbed with clean water and broom, and joints thoroughly grouted with fine cement, mixed with water to the consistency of thick cream. As soon as this begins to thicken, it should be rubbed off with sawdust, or fine shavings and floor left perfectly clean.

Tile for fireplace hearths should be laid in the same manner.

To estimate the number of tile necessary, we will take for example a room 10x16 feet composed of oblong tile 6x1½ inches in size and a border around the edge composed of 6x6 inch blue and white tile. To find the number of tile necessary we proceed as follows:

The area to be covered by the oblong tile 6x1½ inches is 9x15=135

square feet. There are 144 square inches in 1 square foot; therefore 135x144 =19,450 square inches. One oblong tile 6x1½ inches=9 square inches.

19,450÷9=2,161 tile.

It would be better to order 2,200 to allow for breakage.

The border would take 2 to each lineal foot around the room which would be 100 tile for border.

Table X will give the size of many standard tile and the number required per square foot of surface to be covered.

TABLE X

Number of Tile Required Per Square Foot of Area to be Covered

Shape of Tile	Size in Inches	Number in Sq. Ft.	Shape of Tile	Size in Inches	Number in Sq. Ft.
Square	6x6	4	Oblong	3x1½	32
Oblong	6x4	6	Oblong	3x1	48
Oblong	6x3	8	Oblong	2⅛x1 1/16	64
Oblong	6x2	12	Octagon Diagonal ½	6x6	9 1/7
Oblong	6x1½	16	Octagon Square ½	6x6	9 1/7
Oblong	6x1	24	Octagon Square ¼	6x6	18 2/7
Square	4¼x4¼	8	Hexagon	6x3	10 2/3
Square	3x3	16	Hexagon Long ½	6x3	21½
Square	2x2	36	Hexagon Short ½	6x3	21½
Square	1x1	144	Octagon	3x3	18 2/7
Square	½x½	576	Hexagon	6x5 3/16	6 1/6
Diagonal ½	6x6	8	Hexagon Diagonal ½	6x5 3/16	12½
Diagonal ½	4¼x4¼	16	Triangle	3	37
Diagonal ½	3x3	32	Half Triangle	3	74
Diagonal ½	2⅛x2⅛	64	Triangle	1 7/4	109 2/7
Diagonal ½	1½x1½	128	Half Triangle	1 7/4	219 2/7
Diagonal ½	1 1/16x1 1/16	256	Triangle	1 5/2	249
Oblong	4¼x2⅛	16	Half Triangle	1 5/2	298
Oblong	4¼x1 1/16	32			

Mosaic Tile

Mosaic tiles are first examined to ascertain if design is right. They are laid in the same manner as ordinary tile, that is, a concrete foundation is prepared between the joists and the tile are set into the cement mortar. Cement mortar is spread evenly and leveled with screed. Sheets of papered mosaic tile are laid carefully on mortar with paper side up. After space is covered, the tile setter should press tile into mortar gently at first, firmly afterwards, using block and hammer, leveling tile as much as possible.

Fig. 79—Neat appearance of Bath Room with sanitary floor and wainscoting.

In large areas of floors, about every third or fourth row of sheets should be laid to a chalk line to avoid bad kinks in line of tiling after the floor is finished.

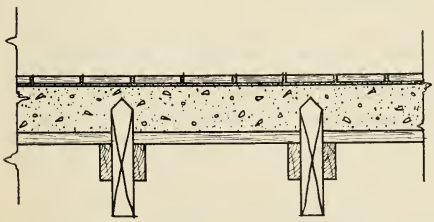


Fig. 80—Shows construction of joists for tile floor.

Tile should be beaten down until the mortar is visible in joints through paper, however, without breaking it. Paper is then moistened and after being well soaked, can be easily removed. It is pulled off backwards starting at the corners. After removing paper, tile should be sprinkled with white sand

before finishing the beating so that tiles will not adhere to beater owing to paste which is used in mounting them. Connections of surface are then made by leveling with block and hammer. The filling of joints and cleaning of surface are delicate operations, as the looks of the floor will depend largely upon them.

Joints are to be filled with clean Portland cement mixed with water. This mixture is forced into the joints with a flat trowel. Do not use a broom. After joints are filled, surplus cement is removed from surface by drawing a wet piece of cotton flannel over it. This cloth must be washed frequently with clean water. After floor is clean, it should be allowed to stand for a day or two; then the whole floor is to be rubbed off with sharp sand and block of soft lumber. This treatment removes the last trace of cement.

In laying these mosaic tile sheets, care should be taken to see that spaces between them are the same as between small tiles on sheets, so as not to give floor a block appearance.

Mosaic tile will cost from 20c to 30c per square foot and are made in many pleasing colors and designs. A great saving can be made by using this method of laying tile, but only the smaller sizes are so mounted.

Cleaning Floor Tile

Remove with sawdust, and afterwards wipe off with flannel cloth and water, all traces of cement left on surface of tile, as it is hard to clean after it is set. After thoroughly cleaning floor, cover with sawdust and keep boards placed on floors for several days where it is necessary to walk upon it.

A white scum sometimes appears on the surface of tile, caused by the cement. This generally can be removed by washing frequently with plenty of soap and water. If scum or dirt cannot be removed by washing, then use a solution of muriatic acid and water (6 ounces of acid to a bucket of water) applied with a scrubbing brush. Allow acid to remain on floor only a few minutes and then wash off.

Caution should be taken not to allow anyone to walk upon or not to carry anything heavy over the floor or have any pounding about the work for several days or until the tile is firmly set. Unless these precautions are taken, it will be impossible to guarantee a first class job. Tile work is often condemned when the fault lies in the rush of other contractors to finish their work.

Do not allow tile to get wet and lie in sawdust, as it will stain the tile.

Asbestone

This is a composition flooring which is sanitary, fireproof and durable. It is applied like cement or plaster, to floors, and walls (as wainscoting). It consists of a dry powdered material which is shipped in paper lined bags. This powder is mixed with a soluble crystal compound. The soluble crystal compound is dissolved in water and mixed with the dry powdered asbestone, in an ordinary mixing box such as plasterers and bricklayers use. The plastic mixed material is spread over the floor in an even layer and troweled to a smooth, even surface with an ordinary finishing trowel.

It may be laid on wood, concrete, brick or steel with equal success, but it must not be laid over lime mortar or any compound of lime.

When laid over a wood foundation, it is necessary to first apply a number 26 or number 27 gauge painted expanded metal lath. To secure a firm bond with the under floor, asbestone should be applied ½ inch thick. If a greater thickness is required the manufacturers of this material make a cheaper filler to level uneven floors. When laid ½ inch thick asbestone weighs little more than ordinary wood flooring or about 3 pounds per square foot.

Ordinarily, this material will set over night and will be ready for use if applied in a heated building. However, it is a non-freezing material and can be applied in freezing weather, but better results are obtained if applied when the temperature is 40 degrees Fahrenheit or above.

Asbestone is resilient and therefore not slippery. It is the same consistency throughout and will not show wear. The cost is about 14½c per square foot for a coat ½ inch thick. This is for sufficient material of the dry powdered asbestone and soluble crystal compound.

It is furnished in six different colors—light and dark red, light and dark buff, gray and black. Very pleasing and attractive results may be obtained by combining a dark colored border (or base and border) with a lighter color for the main portion of the floor, (known as the field). In this connection we would suggest:

Black Border ..... Gray Field
Black Border ..... Red Field
Black Border ..... Buff Field
Red Border ..... Gray Field
Red Border ..... Buff Field

Any additional information about this material can be obtained from The Franklin R. Muller & Co., Waukegan, Ill.

Marbleoid

Marbleoid is a standardized, permanent, light weight, fireproof and resilient covering for floors, coved sanitary base, wainscoting, trim, etc. It is laid plastic, usually ½ inch thick, and sets in a few hours into a seamless, tough body, possessing a fine grained, smooth surface. Thus the marbleoid forms a hermetic seal, offering neither joints nor crevices for the accumulation of germs, dirt or moisture.

The fact that it is jointless and remarkably free from cracks caused by uneven settlement, working or vibration of buildings, gives it unusual sanitary value. It is easily kept clean; is quiet under tread; owing to its elasticity, it possesses high resistance to abrasion; is not slippery; is waterproof; owing to its plasticity, it is not fatigueing to walk on; is a non-conductor of heat, and therefore, never cold and it has great crushing and structural strength.

Marbleoid adheres firmly to wood, concrete or iron, and may be used to reinforce old floors, as well as new. It is made in all colors, the fastness, softness and variety of the mineral colors used offer unusual possibilities in the working out of any color scheme.

Additional information can be obtained from the Marbleoid Co., Marlbridge Building, Broadway and 34th Street, New York, N. Y.

Special Roofing Materials

Slate Shingles

SLATE is mined along the Blue Ridge Mountains in Pennsylvania, Virginia, Maryland; also in Vermont and New York. By far the greater bulk of the output used in the United States comes from these regions.

Slate roofs are used considerably at the present time, with good results, in localities where they can be obtained cheaply. Although we do not furnish slate roof covering, we do not think that it would be out of place to

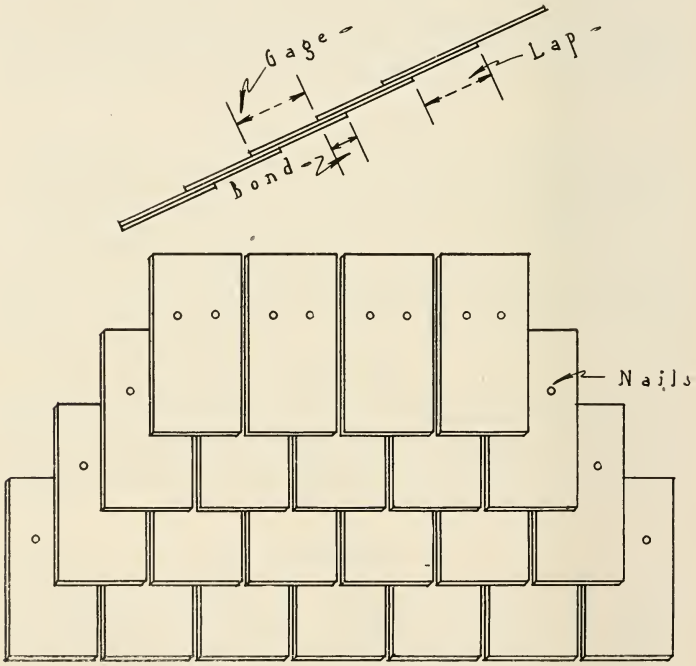


Fig. 81—Shows lap, gauge and bond of slate Shingles.

give a little helpful information in regard to applying and cost of slate shingles, as many of our customers use them on ALADDIN buildings and have the regular wooden shingles omitted. When a good quality is obtained and ap-

plied in the proper manner, it no doubt will give a very satisfactory and lasting roof covering.

Slate shingles can be obtained in different colors, black, green, natural, unfading green and unfading red. Sometimes different colors are used in order to obtain an ornamental effect.

The sizes of slate shingles vary from 6x12 inches up to 24x44 inches. The common sizes in general use are 6x12 inches to 12x18 inches. The thickness of the slate shingles vary from 1/8 to 3/8 inch, but the usual size is 3/16 inch in thickness.

Slate may be laid either on regular sheathing laid tight or on roofing strips 2 to 3 inches wide and 1 to 1¼ inches thick, fastened to the rafters the same distance apart corresponding to the gauge of the slate, that is, if shingles are to be laid 5 inches to the weather, the roofing strips should be placed on 5 inch centers so that the nails will come into them.

Where sheathing is laid solid, a layer of tarred felt or waterproofing paper is usually placed between slate and roof sheathing to act as a cushion for the shingles, which will prevent them from cracking, should there be any vibration to the roof.

We would advise that your sheathing be laid tightly over building, and also be sure that your roof is properly braced, as slate shingles will add considerable weight for rafters to carry.

Start at the eaves of the building and work upwards and lay with a 3 inch lap, that is, the slate shingles in the third course will overlap those in the first course by 3 inches. See Fig. 81 for lap, gauge and bond of slate roofing.

The shingles should project over the eave of your building about 1½ inches. They are usually punched for nails before delivered so that it is possible to lay them only one way.

The nails should be three or four D and must not be allowed to project up above the surface of the shingles, in which case it would damage the overlaying slate. Galvanized nails should be used.

As the courses of slate approach the ridge, a slight variation in lap is permissible so as to finish at the ridge without cresting.

The ridges and valleys of roof are generally of metal. Flashings should extend well in under slate shingles to prevent back flow of water from heavy rains.

The cost will vary in the locations where they are purchased, according to the size, color and quality.

The labor charge may be based upon 1½ to 2 squares of slate per day of 10 hours per man.

Where Elastic cement is used, the cost of that part of the roof, which is laid in cement, will be increased from $1.50 to $2.00 per square.

TABLE XI

Number of Slate Shingles and Nails for 100 Square Feet of Roof

Size.	Exposure Laid, Inches.	No. to 100 Sq. Ft.	Lbs. 3D Nails.
6x10	3½	686	7⅞
7x10	3½	588	6¾
8x10	3½	514	5⅞
6x12	4½	533	6
7x12	4½	457	5¼
8x12	4½	400	4⅝
7x14	5½	374	4¼
8x14	5½	327	3¾
10x14	5½	261	3
8x16	6½	277	3⅛
9x16	6½	246	3
10x16	6½	222	2½

TABLE XII

Weight of Slate Required for One Square of Roof

Length in inches	Weight in pounds, per square, for the thickness							
	⅛″	3/16″	¼″	⅜″	½″	⅝″	¾″	1″
12	480	725	968	1450	1938	2420	2900	3870
14	460	688	920	1370	1845	2300	2760	3685
16	445	668	890	1336	1785	2230	2670	3568
18	435	650	870	1305	1740	2175	2608	3480
20	425	638	850	1276	1708	2130	2555	3408
22	418	625	836	1255	1675	2094	2508	3350
24	412	616	825	1238	1655	2066	2478	3307
26	408	610	815	1222	1630	2039	2445	3265

TABLE XIII

Weight of Slate per Square Foot.

Thickness Inches	⅛	3-16	¼	⅜	½	⅝	¾	1
Weight Lbs.	1.80	2.70	3.62	5.47	7.25	9.06	10.9	14.5

Semi-Slate Shingles

OWING to the ever-increasing demand for a good substitute for wood shingles, that will have both fire and weather-resisting qualities and give a pleasing appearance, we recommend ALADDIN semi-slate shingles, which, when applied, have none of the undesirable features of prepared roofing, but will give the appearance of slate roof and a more beautiful and better appearing roof is hard to obtain.

The base of this shingle is very heavy, three-ply, long fibre, wood felt, thoroughly saturated with fine Trinidad asphalt. The surface is natural colored crushed rock worked into the roofing so thoroughly that it becomes a part of the body of the roof and will never wear off.

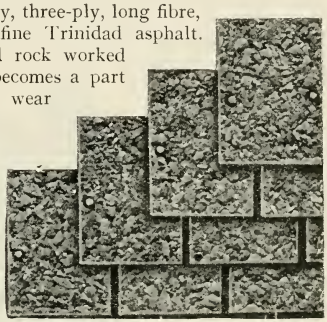


Fig. 82—Shingles as they appear when properly laid.

Each shingle is 8x12¾ inches and should be applied as follows: For the first course across the roof, use one-third of the shingle. For the second course, use two-thirds of the shingle, and above that, use the full shingle. (See Fig. 82.) As they are laid 4 inches to the weather, you can readily see that there will be three thicknesses of these shingles on every point of your roof.

When laid, the roof is approximately one-half inch thick, three coats of long fibre felt, fine Trinidad asphalt and slate. This roof will last as long as the foundation upon which it is applied and is one which will resist fire, water, acids, and alkalies. It will not warp, curl or scale off.

The shingles should be laid with about one-half inch between each one and nailed with the large head roofing-nails furnished for that purpose. Be sure to drive the nails straight into the roof, but do not drive them down so that they will cut shingles. It is advisable to lay roof sheathing solid on the roof when semi-slate shingles are to be used.

The shingles are packed in cartons, four of which will cover a square of roof. It takes about three pounds of nails to lay each square. When semi-slate shingles are furnished with your building, we advise using semi-slate roofing to flash the valley, hip and ridge. This roofing should be cut into strips and flashed under the shingles in the valleys, and over the shingles on hip and ridges. Flash back far enough to prevent water from flowing under the shingles.

It is advisable for the workmen to wear soft rubber soled shoes, when working on the roof, so they will not damage the shingles.

A chalk line can be used in spacing, which will prevent pounding nails into wood spacing strips. A slight difference can be made in the lap to bring the layers out even at the end of the roof or at the ridge of the building.

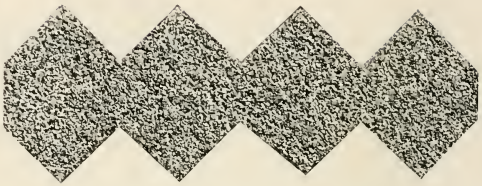


Fig. 83—Showing One Section of Shingles.

The semi-slate shingles are also furnished in diamond point slabs. Instead of being put up like individual shingles, they are in gangs of four shingles to the sheet. Width, 32 inches; length, 12¾ inches from point to point. They give identically the same protection that individual shingles give, but a far more handsome appearance. Many artistic effects are obtainable with these slab shingles which cannot be produced by individual shingles. For an example of this, the roof which we illustrate can be laid with half red shingles and half green shingles, making a striking appearance when completed.

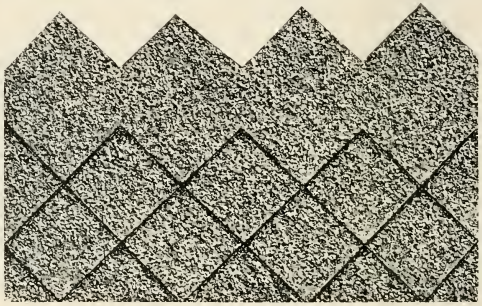


Fig. 84—Showing Shingles Laid Diamond Style.

Aladdin Diamond Point Slab Shingles, when compared to the individual shingles, show a saving of about 75 per cent. in labor, because it only takes 112 pieces to cover 100 square feet. They automatically space and gauge themselves to the weather,—save about 35 per cent in freight, on account of the difference in the amount of material per square, they weigh sixty pounds per square less, and about 38 per cent in nails. is saved because four shingles are laid with five nails. To say nothing of the time and labor which can be saved on account of handling only one piece when ordinarily you would handle four pieces. Fig. 83 shows one slab of Diamond Point semi-slate; Fig. 84 shows slabs laid Diamond style; Fig. 85 shows shingles laid block style.

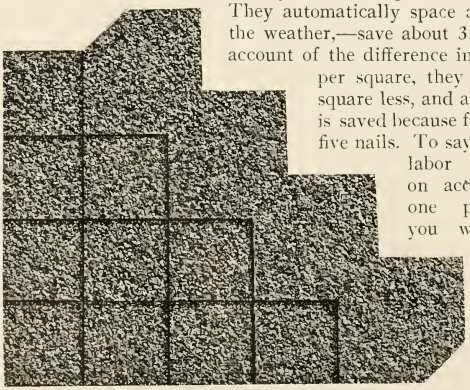


Fig. 85—Showing Shingles Laid Block Style.

Tin Roofing

IN some cases, where low pitched roofs are used, it is necessary to use tin for the roof covering, which, when properly applied, will be lasting and give a fairly good appearance. It is a good protection against fire and is subject to less contraction and expansion than any other metal used.

Tin plates for roofing are made of coating plate iron, or steel sheets with tin, or with amalgam of lead or tin.

In applying the tin, it is necessary to bend or fold the edges so that one sheet will intersect with the other. The sheets should also be laid so that the joints will alternate, that is, start one row with a full sheet and the next with a half sheet. A sheet of tin, say 18x24 inches with ½ inch edges, measure when edged or folded, 17x23 inches or 391 square inches, but its covering capacity when joined to other sheets on the roof, is only 16½x22½ or 371¼ square inches. In other words, it requires about 1/7 more tin than the actual surface of the roof to allow for edging and folding the sheets. If the surface of the roof measured 350 feet, it would take about 400 feet of tin to cover it.

There are two general methods of laying tin roofing. The flat seam method has the sheets of tin locked into each other at the edges, with the seam either flattened and fastened with the tin cleats or nailed firmly and soldered water tight. In flat roof work, the tin should be locked and soldered at all joints and held in place by tin cleats.

Two good average workmen will put on and paint about three squares of tin roofing in a day of ten hours. It will take about five pounds of solder, one pound of rosin and from one to one and a half pounds of roofing nails for each square of roofing where the sheets are 20x28 inches. If sheets are 14x20 inches allow about 7½ to 8 pounds of solder to a square.

Paradux

ON some roofs where the pitch is not sufficient to shed water from wood shingles, as you find many times on flat porch or dormer roof, we furnish a composition roofing, which should be laid according to the following instructions.

Directions for Laying Regular Paradux

Paradux should be laid with the canvas side up.

It must be given one coat of paint immediately after laying, followed by another coat of paint as soon as the first coat is dry. Do not paint before laying.

Never allow Paradux to get wet or to lay over night without having had at least one coat of paint.

The roof surface should be smooth and even and swept clean. Use dry boards of uniform thickness, laid close together.

Lap the sheets two inches along the edges and four inches at ends or butts. Do not allow two butts to come end to end.

IMPORTANT: Cut the sheets to the proper lengths and allow them to lay flat for several hours before nailing them in place. This is done to remove the "creep" or form of the roll from the sheet.

NAILING: Use large head nails placed 1½ inches apart and ½ inch from edge of sheet. Commence nailing at the middle of sheet and nail toward the ends.

CEMENTING: Cement thoroughly between all laps, butts, in valleys, etc., using cement furnished. Be careful that cement is not daubed beyond the lap onto the canvas surface which is to be painted. Do not allow cement to ooze out beyond edge of lap. If it does, wipe it off with a rag moistened with turpentine.

Paradux on Sleeping Porch Floors, Balcony Floors, Roof Garden Floors and Decks of All Kinds

The surface to be covered should be smooth and clean. Lay the Paradux so that the strips will be walked on lengthwise more than across the seams. When Paradux is laid adjacent to a wall, it should be flashed up against the wall at least six inches with metal.

When walls are finished with shingles or clapboards, carry the Paradux up under finish at least six inches.

If there is a door opening out from the balcony, run Paradux under the door sill.

When Used in Valleys

Fold into each valley a strip of Paradux 18 inches wide. See that it fits snugly against the boards at center of fold in valley. Then put a few nails along each edge of strip to hold it in place.

Laying Across the Slope

If the roofing is to be laid across the slope, lay the first sheet along the eaves and parallel to them. Bend the lower edge of the sheet over the eaves and nail every two inches. A wooden batten can be nailed along the eaves to hold the roofing. This first sheet should lap over the gutter lining and valley strip. Bend the ends of the sheet two inches over gables and nail on batten as at the eaves.

Strike a chalk line along this first sheet two inches from the upper edge and roll out the second sheet, using chalk line as guide to make a two inch lap. On a steep roof put a few nails at the top to hold sheet, then cement the lap thoroughly.. Use plenty of cement. Commence nailing the lap at the middle of the sheet and nail toward the ends. This is important. Continue up the roof in this manner, carrying top sheet over the ridge, nailing it securely. Lap the ends of each sheet over the valley strip at least five inches. Cement thoroughly and nail.

Laying Up and Down the Slope

Lay the first sheet parallel to the gable edge, projecting two inches beyond it. Bend it over the edge and fasten with nails or wood battens. Lap

each sheet two inches over the preceding sheet. Cement thoroughly between laps and then nail, commencing at the middle of the sheet and working toward both ends. Carry the sheet over the eaves and nail as at gable edge. At the valleys, cut ends of the sheets at the proper angle to fit the valley and lap ends over the valley strip at least five inches. Cement and nail. Finish or cap ridge with a strip of Paradux eight inches wide.

FLASHINGS: When a wall is encountered, a flashing formed with a strip of Paradux Roofing should be extended up the wall for about six inches and out onto the roofing, forming the main body of the roof for about six inches. This should be thoroughly cemented on the under side and carefully nailed.

It should be fastened on the wall with a strip or wooden batten. This also applies to chimneys, skylights and other projections. Take special care with flashings, in order to avoid all possibility of leaks. Any counter-flashings used should be of metal.

Heating

MANY improvements have been made of late in the methods used in heating dwelling houses and also in the apparatus used for that purpose. But it is only of late that any thought has been given to the ventilation of the home, which is a very important thing to take into consideration when planning your heating plant.

While it is impossible for us to go into detail on the question of heating, it is believed that the following information will be of value to an ALADDIN builder.

With each furnace that is sold by us, we send a detailed blue print and a set of instructions explaining just how the furnace is to be installed, but the following information will be of value in helping our builders decide upon the kind of heating to be used, and in selecting an economical and efficient apparatus and seeing that it is properly installed.

In deciding upon a heating plant for a dwelling, the builder should consider the following conditions:

(1.) The size of the building.
(2.) The first cost.
(3.) The operating cost.

We would recommend a hot air furnace for smaller houses and hot water and steam for the larger dwellings. Of course, this will depend largely upon the location, the weather conditions and the fuel which can be obtained.

For warming residences not exceeding 1,200 square feet of ground area, we believe a warm air furnace properly set and with hot-air pipes of proper size, suitably located, will give the best satisfaction, as it is economical in the first cost, easy to manage, costs little for repairs, and will furnish a pleasant and healthy heat at no greater expense of operating than steam or hot water.

The most common defects observed in warm air furnace heating plants are overheating of the air, bad air caused by gases of combustion and uneven distribution of the heat. The first two defects may be done away with if care is given to the setting of the furnace and tending of the fire. The last one can be reduced by proper placing of registers and proper sized flues.

Furnace heating may be divided into two parts: the production and the distribution of the heat. The former depends largely upon the furnace, its setting, cold air supply, draught, kind of fuel and attendance.

A hot air furnace is simply a stove or heater encased with brick or iron so as to form an air chamber between the heater and the casing. The air enters the bottom of the chamber thru a cold air shaft, passes over the heated surface of the heater and is conducted by the hot air pipes, to the various rooms. The external surface of the fire pot and all portions of the heater which receive heat from the fire or smoke, are called the radiating surfaces.

The cold air inlet is at the bottom, and the hot air pipes at the top. These are all provided with dampers for shutting off or regulating the amount of air flowing thru them. The feed or fire door is at the front with the ash door beneath it. A cold water pan is also placed in each furnace, to moisten the air before it is forced into the rooms.

A furnace should be so placed that the warm air pipes will be of nearly the same lengths. The air travels most readily thru pipes leading toward the sheltered side of the house and to the upper rooms. Therefore, pipes leading

toward the north and west as to the rooms on the first floor, should be favored in regard to length and size.

Furnace smoke pipes range in size from 6 to 9 inches and should be carried to the chimney flue as directly as possible so as to insure a good draught. Avoid bends in smoke pipes as much as possible, as they increase the resistance and diminish the draught. Smoke pipes should be covered, if of any length, so as to prevent the loss of heat and the condensation of smoke.

The cold air box should be large enough to supply a volume of air sufficient to fill all the hot air pipes at one time. If the supply of cold air is too small, the cellar will become overheated from the loss of air to carry away the heat generated. The intake for the cold air should be so placed that the prevailing winds will blow into it. It is sometimes a good plan to bring cold air from underneath a porch or from the inside of the house close to a window.

The hot air pipes should all be covered so as to prevent the loss of heat and to insure all the heat generated being carried into the rooms. These pipes should contain checks or dampers so that the heat can be regulated.

From the above, we can easily see that the following instructions should be carried out in order to have a successful warm air furnace.

First, proper size furnace for cubical contents of house. A 20 inch fire pot is large enough for a building up to 8,000 cubic feet; 22 inch for building from 8,000 to 15,000 cubic feet; 24 inch for building from 15,000 to 20,000; 26 inch for building from 20,000 to 25,000 cubic feet and 28 inch for building from 25,000 to 35,000 cubic feet. The second important point to consider is the supply of cold air which should be equal to the supply of air in the warm air pipes. It is best to bring the supply from the coldest point of the house and sometimes better to have two cold air shafts, one from inside and one from outside of the building. Do not place cold air shaft where it is apt to be partly checked with rug or pieces of furniture, as this will reduce the radiation.

The third important item is to utilize and get the benefit of every heat unit possible. To do this, the furnace must be well covered. The galvanized jacket should be tight seamed and heat-resisting. It is a good investment to cover the

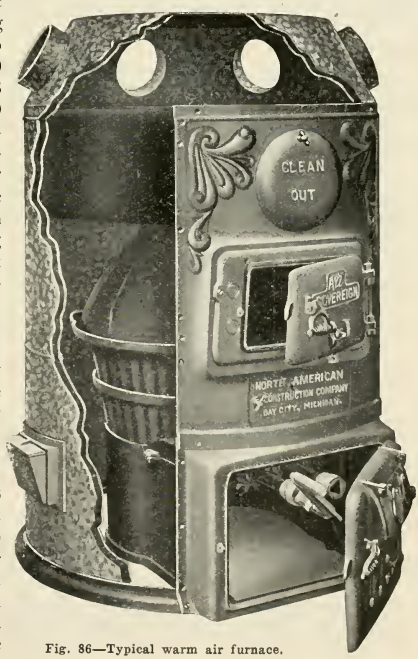


Fig. 86—Typical warm air furnace.

jacket with asbestos and cover the top of furnace with sand if the jacket does not extend over it.

If the depth of the cellar is not sufficient to give a good fall to the warm air pipe, the furnace should be lowered into a pit, as warm air will have a tendency to travel up and the circulation will be very poor if the air pipes are not set properly.

Another very important thing to consider in the location of the furnace to have an even temperature. The furnace and register should be located so they will be as near as possible an equal distance apart.

Care of Furnaces

The fire should be thoroughly shaken two or three times daily in cold weather. It is well to keep the fire pot full at all times, for in this way, a more even temperature can be maintained, less attention is required, and no more coal is burned than when the pot is only partially filled. In mild weather, a mistake is often made by carrying a thin fire which requires a great deal more attention and is likely to die out. Instead, in a moderate temperature, keep the fire pot filled and allow the ashes to accumulate upon the grate. The ashes will hold the heat and render it an easy matter to control the fire.

Keep the ash pit free or cleaned out, so as to prevent the melting or warping of the grate.

In case the warm air fails at times to reach certain rooms, it may be forced into them by temporarily closing the registers in the other rooms. The current once established will generally continue after the other registers have been opened.

It is a better plan to try and keep an even heat in your house during the twenty-four hours of the day. When heat is shut off at night and building allowed to partly cool, heat in walls is dissipated and must be replaced each time building is to be heated. Therefore, if an even temperature is maintained throughout the twenty-four hours, the loss of heat by absorption and dissipation thru walls is greatly decreased.

Formula and Rules for Installation of Warm Air Furnaces

TABLE XIV.

Table of Warm Air Pipe Diameters for Residence Heating

Contents of Room. Cu. Ft.	1 Outside Exposure.	2 Outside Exposures.
Up to 1300	1— 8 in. pipe	1— 8 in. pipe
1300 to 1800	1— 9 in. pipe	1—10 in. pipe
1900 to 2400	1—10 in. pipe	1—11 in. pipe
2500 to 3000	1—11 in. pipe	1—12 in. pipe
3100 to 3600	1—12 in. pipe	1—14 in. pipe
3700 to 4200	1—14 in. pipe	2—11 in. pipe
4300 to 4800	2—11 in. pipe	2—12 in. pipe

For rooms with unusual exposure, figure one size larger pipe than called for in the above table; for the second and third floor rooms, one size smaller.

Rules for Pipes

1. Each warm air pipe should have an upward pitch from the heater of not less than one inch per foot.

2. The pitch of all warm air pipes should be alike. Equalize by bringing down lower into the cellar the boxes of the shorter warm air pipes.

3. The table of warm air piping in this formula applies where cellar or basement pipes are not over 15 feet in length.

4. When a warm air pipe in cellar is more than 15 ft. long, add ½ inch to the diameter of such pipe for each 5 ft. or part thereof, of length in excess of 15 ft. (or, when odd ½ inch sizes of pipe are not used,) add 1 in. to diameter of pipe for each 10 ft. or part thereof, of length in excess of 15 ft. In such case, the capacity of a riser should be increased to equal the capacity of the cellar pipe.

5. An offset in the riser pipe is equivalent to an addition to the length of the cellar pipe, and should be counted in when measuring the total length of the cellar pipe.

6. All warm air pipes in cellar or basement should be covered with non-heat-conducting pipe covering. Not less than ten pound sheathing is recommended.

7. All warm air risers should be carried up in inside partitions, wherever possible.

8. In cases where it is absolutely necessary to carry up warm air risers in outer walls, such risers should be so thoroughly protected as to be completely insulated.

9. In using double wall pipe, the capacity should not be reduced.

10. A separate compartment should be made in the crown or bonnet of the surface for each extra long or winding air pipe, thus insuring a positive supply of warm air to that pipe.

11. NEVER USE SMALLER THAN EIGHT (8) INCH PIPE.

12. When warm air pipes are taken out of the top of the bonnet of the heater, the tops of all the elbows should be on a level, so that an equal current of air can fill all the pipes.

NOTE: As a 12 inch elbow is so much higher than an 8 inch elbow, in order to have both pipes work properly, the top of the 8 inch elbow should be as high as the top of the 12 inch. This applies to all pipes taken from the top of the heater. The same rule applies as nearly as possible where pipes are taken from the side of the bonnet.

13. Rooms on the sides of the house exposed to prevailing winds should always have one size larger pipes and registers than the same size rooms on the sides of the house not so exposed.

14. Rooms having bay windows and considerable more than the average glass surface on the northern side of the house, should have two sizes larger warm air pipes and registers than the same sized rooms without this extra glass surface on the southern side.

15. Where warm air pipes pass thru the wall in the cellar, an air space around the pipes should always be left. Never mason a pipe in solid, that passes thru a wall in the cellar, as the wall chills the pipe and makes that pipe almost worthless.

16. All warm air pipes should have dampers close to the heater, so the heat from them can be regulated.

17. All rising pipes in partitions or walls should be enlarged or boxed out where cellar pipes enter them. This is necessary to avoid friction and insure a rapid flow of air.

18. All rising warm air pipes running from second to third floor should always have damper above the register on second floor. Rising pipes should be wrapped with asbestos and studs lined with tin, using wire or iron lath to plaster on.

19. The friction from abrupt bends or acute angles in warm air pipes must be avoided.

20. Fireplaces in rooms having flues 12x12 ins., which is equal to 144 square inches, or 8x12 ins., which is equal to 96 square inches, or 8x8 ins., which is equal to 64 square inches, will in cold or windy weather, pull off more air from a room than the warm air pipes can deliver. In such cases, use sheet iron throat pieces with sliding damper in fireplace flue. The ventilation can thus be regulated as desired.

21. In heating a room on the cold side of the house, or a room having a large amount of glass surface, place one register in the floor as near as possible to the furnace and place a cold air register face in the floor under or near a window and connect this cold air register by means of a separate duct to the bottom of casing, thus removing the cold air out of the room and at the same time providing a flow of warm air into the room.

22. The heater must be attached to a chimney flue of correct construction, one that will furnish sufficient draft to insure a good combustion of fuel.

23. THE FRESH AIR SUPPLY TO THE HEATER MUST BE ADEQUATE.

Pipe and Register Sizes

The table below is printed in order that installers may be able to see at a glance, equivalent areas of round pipes, flat register pipes, risers and registers.

Risers to rooms above the first floor should be large enough to supply to the room to be heated the proper volume of warm air.

On account of this increasing velocity on the upper floors of a residence, smaller pipes can be used than those to the first floor, but the necessary free air opening into the upper rooms must not be overlooked.

TABLE.

All Measurements In Inches.

Diameter of Round Pipe.	Area of Pipe. Sq. In.	Size Flat Riser Pipe.	Size Side Wall Register.	Size Round Floor Register.	Size Rect. Floor Register.
8	50	3½x14	8x12	12	8x12
9	64	4 x16	10x12	14	10x12
10	78	4 x20	12x12	14	10x16
11	95	6 x16	12x15	16	12x15
12	113	6 x19	14x15	18	12x20
13	132	6 x22	14x18	18	14x18
14	154	8 x19	16x18	20	14x22
15	176	8 x22	16x20	24	16x20
16	201	8 x25	18x20	24	16x24
17	227	10 x23	18x24	24	18x24
18	254	10 x26	20x24	24	18x27
19	283	12 x24	20x26	28	20x26
20	314	12 x26	22x26	28	20x30
21	346	12 x29	24x27	30	22x30
22	380	14 x27	24x30	30	24x30
23	415	14 x30	27x27	30	24x32
24	452	14 x32	28x28	36	24x36

Registers

1. The proper size registers to be used for any given number of square inches pipe capacity, may be determined by referring to the Table of Pipe Sizes, shown above.

2. The velocity of warm air carried to rooms on upper floors, is greater than the velocity at first floor registers, and for that reason, it is apt to cause unpleasant drafts, if register faces are used smaller than is proper for the delivery of that increased velocity.

3. It is good practice to select a register for a room on the upper floors as though it were a first floor register, running the riser pipe to a register box enlarged sufficiently to take this size register.

Table of Averages

If it is desired to ascertain the approximate size of pipe required without reference to the cooling surfaces, but only taking into consideration the dimensions of the room, the following table may be used.

Table below shows the proper size of furnace pipes (the lower number shows the size pipe for first floor, the upper number the size pipe for second floor) to heat rooms of various dimensions, when two sides are exposed, temperature at register 140 degrees, room 70 degrees, outside zero. Rooms 8 to 17 feet in width assumed to be 9 feet high. Rooms 18x20 feet in width assumed to be 10 feet high. For other heights, temperatures or exposures make a suitable allowance. When first floor pipes are longer than 15 feet, use one size larger than that stated.

TABLE XV

Length of Room in Feet	Width of Room in Feet												
	8	9	10	11	12	13	14	15	16	17	18	19	20
8	8 8	8 8											
9	8 8	8 8											
10	8 8	8 8	8 8										
11	8 8	8 8	8 8	8 9									
12	8 8	8 8	8 9	8 9	8 9								
13	8 8	8 9	8 9	8 9	8 9	8 10							
14	8 9	8 9	8 9	8 9	8 10	8 10	8 10						
15	8 9	8 9	8 9	8 10	8 10	8 10	9 10	9 10					
16	8 9	8 9	8 10	8 10	8 10	9 10	9 10	9 11	9 11				
17		8 10	8 10	8 10	9 10	9 10	9 11	9 11	9 11	9 11			
18		8 10	8 10	9 10	9 10	9 11	9 11	9 11	9 11	10 12	10 12		
19			9 10	9 10	9 11	9 11	9 11	9 11	10 12	10 12	10 12	10 12	
20			9 10	9 11	9 11	9 11	9 11	10 12	10 12	10 12	10 12	11 13	11 13
21				9 11	9 11	9 11	10 12	10 12	10 12	10 12	11 13	11 13	11 13
22				9 11	9 11	10 12	10 12	10 12	10 12	10 13	11 13	11 13	11 13
23					10 12	10 12	10 12	10 12	10 13	10 13	11 13	11 13	11 13
24					10 12	10 12	10 12	10 13	10 13	10 13	11 13	11 13	11 13
25						10 12	10 13	10 13	10 13	10 13	11 13	11 13	12 14
26						10 13	10 13	10 13	10 13	11 13	11 13	12 14	12 14
27							10 13	10 13	11 13	11 13	12 14	12 14	12 14
28							10 13	11 13	11 13	11 13	12 14	12 14	12 14
29								11 13	11 13	11 13	12 14	12 14	12 14
30								11 13	11 13	12 14	12 14	12 14	12 14

Aladdin Pipeless Furnace

OUR furnaces are always very carefully prepared for shipment similar to illustration Fig. 87 and which should insure all castings arriving at destination in good condition; customers are cautioned, however to thoroughly inspect shipment before accepting same from the railroad company, to see that no damage has resulted while in transit. Shipments always leave our factory in perfect condition and any damage you may possibly find must be reported to your freight agent before accepting furnace, who will issue the proper notation on your freight expense bill, and enable us to adjust your claim satisfactorily.

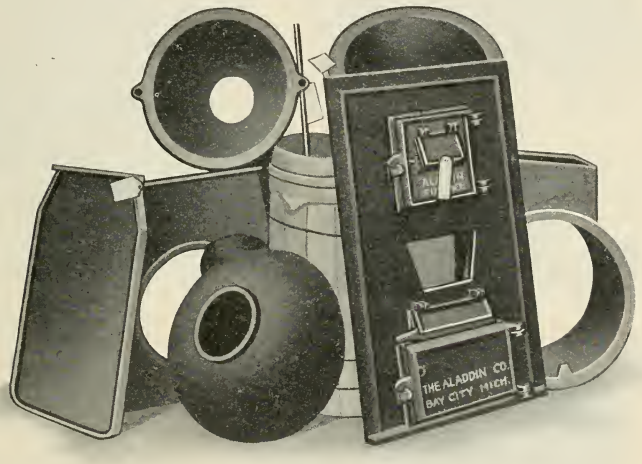


Fig. 87—Aladdin Pipeless Furnace as it arrives at destination.

After transferring the shipment to your home, we presume you are anxious to install the plant at once. The furnace being "knocked down" can easily be taken thru a two-foot door and carried by one person, if necessary, into the basement. We will now proceed to set up the outfit.

First, choose the room which is nearest to the center of your home, preferably the living room, or, if conditions make it otherwise, a dining room which adjoins the living room. It is to be noticed that there will be less than three degrees difference between temperature of the room in which the register is placed and that of any other room in the house; but it is always wise to place the register in that room which is occupied the greater part of the time.

Select a desirable corner where the register will not interfere with rugs, carpets or furniture, preferably a point near the door which leads to the din-

Fig. 88—Base located and showing ashpit being placed in position.

No. 89—Firepot and feed-section are next added.

Fig. 90—Dome and radiator are now in place. Side rods prevent sections from shifting.

ing room, if the register is in the living room, or vice versa.

The size of the warm air floor register being 14x20 inches, mark off, on the floor, the exact size of this register. Then, from the exact center of where the register will be placed, bore a hole thru the floor and drop a plumb line. This will give you the exact center of the foundation for your furnace in the basement.

The next step will be the cutting of your floor to receive the register box. Simply saw thru the floor, following the mark of the register. In doing this, it may be necessary for you to cut off one or more floor joists. In this case the end of the joists you have cut must, of course, be supported by a leader, that is, the parts of the joists which have been cut off may be nailed to the ends of the shortened joists and also to the full length joists on each side, thus supporting the shortened joists.

The distance between the bottom of the floor joists and the foundation

Fig. 91—Front can now easily be bolted on.

of the furnace may be anywhere from 6 feet to 9 feet 6 inches. We supply a register box deep enough to be fitted for any height between the above figures.

Make a smooth foundation of cement or brick directly under the register box with point indicated by plumb bob as the exact center. After your cement foundation has properly set, lay on the cast iron bottom of furnace with front in direction you desire to face furnace. Of course, the location of your coal bin has some bearing on the direction in which the furnace will face. The front of the furnace need have no bearing on the direction in which smoke pipe must run from furnace to chimney, as smoke pipe can run from the furnace at any angle desired.

Next place the ash-pit in position as shown in Fig. 88. In setting up the furnace, we desire to caution you especially to use a sufficient amount of iron cement in the various joints to insure smoke-tight connections between the castings. We furnish a liberal amount of this cement and it is extremely important that its proper application is observed, or smoke is bound to work its way thru the joints and pass up thru the hot-air register into your house; a smoky furnace is surely not only a great annoyance to every one concerned but has its deteriorating effects on interior furnishings and decorations.

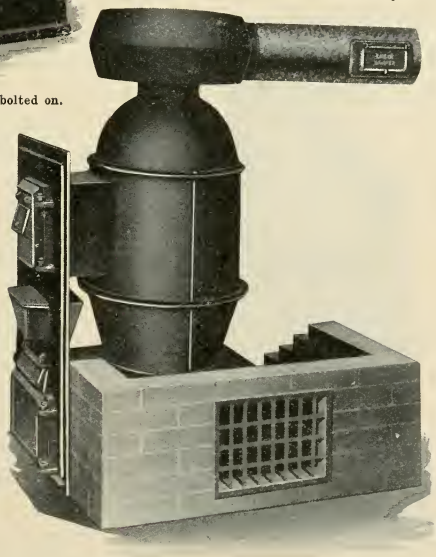


Fig. 92—Directions should be closely followed in constructing the brick jacket.

The fire-pot, feed

section, dome and radiator can now be added in the order mentioned. Here again a bit of further precaution must be taken; before adding the radiator and after dome is in position, insert the tie-rods in holes drilled to receive them and securely clamp the bottom sections together to prevent their shifting and jarring the cement loose. The next operation of adding the radiator we consider one of the most important, as the connection between dome and radiator offers probably a greater opportunity for a smoke leak than found at any other point of the outfit. Before setting the radiator in place, pack a quantity of cement around neck of dome; so that all space will be fully taken up between neck of both radiator and dome. After radiator is in position and pressed down firmly, pack cement all around out-

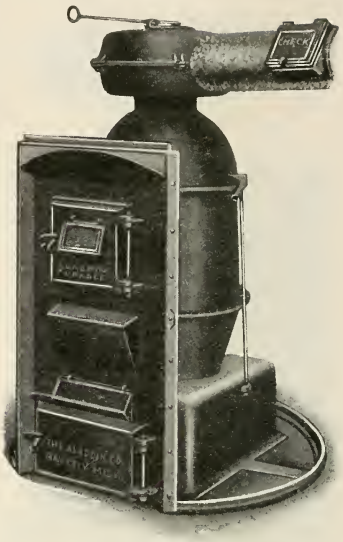


Fig. 93—Aladdin Pipeless Furnace before adding galvanized iron jacket.

side of joint and smoothing off to present a finished appearance. It is also well to reach thru feed door opening up into dome and wipe off the surplus cement which may have been forced thru, being careful not to injure the cement in the joint. The cement will harden in a comparatively short time holding the castings firmly in place; care should, of course, be exercised to not jar castings more than necessary until the cement is hardened.

Next bolt on the front as shown in Fig. 91 and for this purpose you will find included in shipment a number of bolts with nuts of proper size.

Hang the smoke deflector in the feed opening just inside the feed door. This deflector is a flat oblong shaped casting, having two small holes drilled in it. Corresponding with these holes, there are several

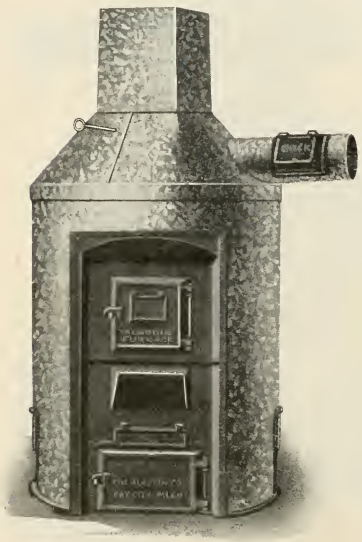


Fig. 94—Aladdin Pipeless Furnace with galvanized iron jacket.

small drilled holes in top of the feed section just inside the feed door and from which the casting can be hung by means of short wires. The purpose of this deflector will readily become evident when the furnace is in operation, in that it affords a means of keeping smoke issuing from furnace when feed door is opened.

We are now ready to place the register box in the hole cut in the floor of room above. Assemble the box from four sheets of galvanized iron which you will find crated and bend over upper edges so that the box can be supported by the floor and held suspended directly over the furnace; before placing assembled box in hole, take the strip of asbestos paper which is furnished and paste securely around upper part of box, letting it extend around to outside of bent-over edge, so that it will thoroughly protect the flooring and floor joists from the heat; the piece of asbestos paper should extend from a point just below bottom of joists and up around flooring several inches, so that at no point will the galvanized box come into direct contact with wood. The box can now be placed in position and register over this. To secure best heating results from the furnace do not allow bottom end of the register box to drop too close to radiator of furnace; if possible allow one foot between them, but this can be varied to suit your special case, and in no case allow the box to rest directly on the radiator or have less than six inches space between end of box and furnace castings.

Now start the brick work for the jacket. This should be 5½ bricks in width across the front and back and 4½ or 5 bricks on either side. Figure 92 illustrates very clearly this step showing cold air grating in place; two of these grates are supplied, one for each side of the jack and which will supply the necessary air to operate the plant. Brick up square with single course to top of front. At this point the trussed bar casting for supporting brick over the furnace front should be placed in position and then jacket should be continued up to second course above the bracket, holding the bracket securely in place. Connect the same pipe, letting the check damper come thru and outside of the brick work.

From this point draw in the next ten or more courses of brick, so that the top course will fit securely up to the register box; continue jacket up around register box so far as convenient.

The grates as illustrated in Nos. 7-8-9, of Figure 95 can now be placed; casting "7" is to pass thru feed door opening and lugs of which will rest on the ash pit. On this ring, place casting 9 after which draw-center casting 8 should be passed thru ash-pit door opening and will slip thru lugs on bottom of casting 10; then force end of draw center up over bottom of draft door opening just above ash-pit door. Casting 10 is a shaker-handle for shaking grates.

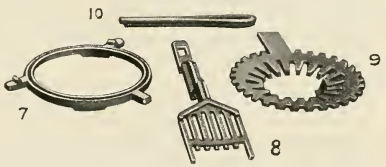


Fig. 95—Pipeless Furnace parts.

Water-pan and hot water coil may be next placed if the latter is to be used. A cover has been furnished for that part of the water pan projecting outside of furnace front.

With chain furnished, connect the check damper and draft door to wall plate, which should be fastened to the wall of a room directly over the furnace. By means of these chains, many trips to the basement are saved, as the furnace dampers may be regulated from upstairs. This done, the furnace is ready for operation. The whole work of setting up the furnace should not take more than four or five hours.

Our instructions for operating should be carefully followed out and will be of great assistance when the furnace is started for the first time.

Bear in mind our guarantee: If, after giving the furnace a thorough trial, you do not feel satisfied and willing to heartily recommend it to your very best friend, we give you the privilege of returning the furnace to us at any time within 365 days from date of purchase and we will refund full purchase price and pay transportation charges both ways.

IF IN DOUBT AT ALL ABOUT THE PRACTICABILITY OF THIS TYPE OF HEATING SYSTEM FOR YOUR HOME, SEND US A SKETCH OF YOUR FLOOR PLANS AND OUR HEATING EXPERTS WILL ADVISE YOU BY RETURN MAIL.

A Few Operating Hints

CAUTION:—Where hot water coils are used, be sure they are filled with water before starting the fire.

Before firing the furnace see that "check" on side of pipe is closed tight and pipe-damper turned open; also that draft-inlet just above ash-pit door is open. After fire is thoroughly burning, close draft inlet; turn pipe-damper almost shut and open "check" on side of pipe from one to three inches, depending on chimney draft; these positions of regulators require no further attention. When more heat is required, close "check" on side of pipe and open draft-inlet.

Before shaking grate, loosen ashes with a poker around fire pot. If coal forms clinkers, draw out the bar to dump them thru. Shake ashes out thoroughly. Let ashes remain in ash box until furnace is fired again before wetting to remove.

To prevent dust entering rooms when removing ashes, close all registers and thoroughly dampen ashes before removing same. It is very important to keep ash-pit clear of ashes at all times; furnace will naturally have a better draft, preventing "blow-outs" and also prevents grates from becoming damaged by overheating.

Thoroughly clean smoke pipe from furnace to chimney at regular intervals, according to grade of fuel consumed.

Be sure and keep the water-pan filled with water at all times to preserve the proper degree of humidity in the air of your residence and not only prevent your furniture from drying out and falling apart, but safe-guard your health.

To meet the demand for a furnace complete with a galvanized iron jacket instead of the less portable brick jacket, we are producing an outfit fully illustrated in Figs. No. "93" and "94". You will observe that the castings of this outfit are almost identically similar in construction to our other furnace and it therefore follows that with the exception of the jacket, practically the same suggestions for setting up can be followed.

The assembling of the galvanized jacket is a simple matter. Jacket is of double construction, having a heavy outside shell with an inner corrugated lining, between which has been placed asbestos paper producing a covering for the furnace which reduces loss of heat through radiation to a minimum; jacket is shipped in three sections, the side walls in two sections and the assembled hood. The two sections forming the side walls are bolted together, holes having been punched for this purpose. Bottom iron ring which bolts to base-plate of furnace and which receives bottom edge of casing is plainly illustrated in Fig. 93. Ends of casings are carefully bolted to opposite sides of furnace-front, holes having also been provided for this purpose. On upper edge of casing the large iron circular ring is placed and on this the hood rests which will fit properly.

Top of hood has been fitted to receive the register-box. The register-box of course will have to be cut to proper length according to depth of basement and is installed just as stated in former directions.

However, before setting up the entire casing permanently, holes must be cut for the two cold air intakes, smoke pipe and damper rod, all of which can be determined by a little careful figuring. The cold air intakes should be placed on either side of the furnace near bottom of casing and openings cut to proper size to receive the bolts passing through the castings supplied for manipulating the cold air slides. Openings for smoke pipe must be governed by direction it is desired to conduct the smoke, being sure to place check draft opening in smoke pipe just outside of casing. The hole for damper rod will, of course, be most conveniently placed in front of furnace casing and as seen in Fig. "94" passes through the hood of casing.

A question may arise in the minds of our customers as to the purpose of this damper-rod. This special type of furnace has the additional advantage of a damper device in the radiator which proves itself a great convenience when firing the furnace. When feeding fuel to the fire-pot in the ordinary furnace, smoke and gas will invariably belch out through the fire-door; our new damper control which operates a recolving smoke deflector within the radiator overcomes this nuisance in a great measure. When firing the furnace the damper-rod should be pulled out as far as possible which revolves the smoke deflector into such a position that all gases and smoke are conducted directly into the smoke pipe; when the fire is under way, the rod is again pushed in, revolving the smoke deflector to position just opposite and causing the heated gases to travel around the radiator, before passing off into the smoke pipe which makes it possible to obtain maximum heating efficiency from fuel consumed.

Furnace front of this outfit is cast in two pieces, which should facilitate handling somewhat.

Care should be exercised to see that the cold air slides are not allowed to close the cold air openings for any length of time when the furnace is in operation; your failure to observe this may result not only in burning out of the furnace castings from lack of air, but your house will not heat up satisfactorily. The opening can be closed temporarily while cleaning basement or removing ashes to prevent dust being forced into the rooms, if the furnace is not allowed to overheat.

Hot Water

THERE is probably no better system of heating today for larger houses, than hot water, and it is being used to a large extent every year.

The system of hot water heating is by circulating hot water into the radiator, instead of steam. The boiler pipe and radiator are all filled with water, the outlet or circulation pipe being attached to the top of the boiler and the return pipe at the bottom. The water in the boiler when heated, becomes lighter, rises and circulates thru the pipes and radiators, leaving a portion of its heat, thus becoming colder and heavier, and passes down thru the return pipes where it is again heated and starts in circulation once more. (Fig. 96 shows how heat causes circulation of water.)

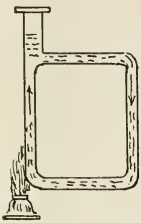


Fig. 96 — How heating of water causes circulation.

Water at 32 degrees Fahr. will not contain any heat units and will weigh 62.42 lbs. per cu. ft. Below 32 degrees water exists in a solid state as ice. At 60 degrees Fahr. it will contain 28.01 heat units and will weigh 62.37 lbs. per cubic foot.

At 100 degrees Fahr. it will contain 68.08 heat units and will weigh 62.02 lbs. per cubic foot; at 212 degrees Fahr. it will contain 180.90 heat units and will weigh 59.76 lbs. per cubic foot; which shows the more heat units the water contains the density diminishes and it becomes lighter in weight, thus causing it to rise in container.

There are two kinds of hot water systems; one with an open and the other with a closed expansion tank.

The system with an open expansion tank is one which is connected with the water pipes so as to reserve the increase of the volume of water which is due to the expansion by heat, and is connected with the outside air by a vent pipe, so that there is no pressure upon the tank.

A similar tank is used in the second system, only the vent pipe is closed and a safety valve is placed on the tank, which will open when the pressure reaches a certain point.

The closed system is not often used, as it is open to the danger of a serious explosion caused by the safety valve refusing to operate.

Tank should always be provided for the reason that when the water has reached boiling point (which depends upon pressure about 212 degrees Fahr.) it has increased in volume so that it occupies a space of 5 per cent. greater than it did at 40 degrees.

The expansion tank should have the capacity containing from 1-30 to 1-20 of the total volume of water contained in the entire system, and should be located, if possible, where there is no danger of freezing and placed so as to bring the bottom of the tank at least 24 inches above the highest radiator in the system.

The expansion tanks should be made of boiler steel, double riveted, caulked and galvanized and tested to two hundred pounds pressure. They should be tapped, top and bottom, for 1 inch overflow and expansion pipe, the latter to be connected with the system in such a manner as to conduct the surplus water into the bottom of the tank. A 1-inch connection for a filling attachment should be made on the side near top of tank, and a 12-inch water gauge glass should be connected on the side near the bottom.

The radiators used in a hot water heating system are constructed a little different than those used in steam heating, in order to improve the circulation.

The two-pipe system of hot water heating is one which has been most successfully used by us. By referring to Fig. 97, you will notice that the return pipe starts out from a low point in the boiler and is parallel to the feed or radiating pipes.

A feed is taken off the supply pipe, radiates up thru the radiator and returns back into the return pipe, not into the supply pipe as is the case in a one-pipe system. The one-pipe system is very impractical, as it is impossible to heat the radiators farther away from the boiler at anywhere near the same temperature as those near it.

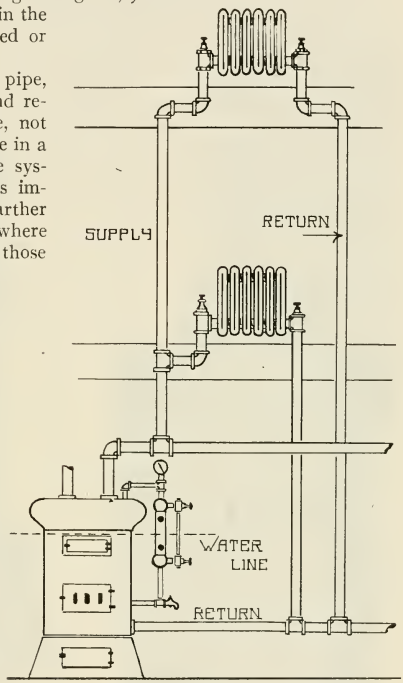


Fig. 97—System of hot water piping.

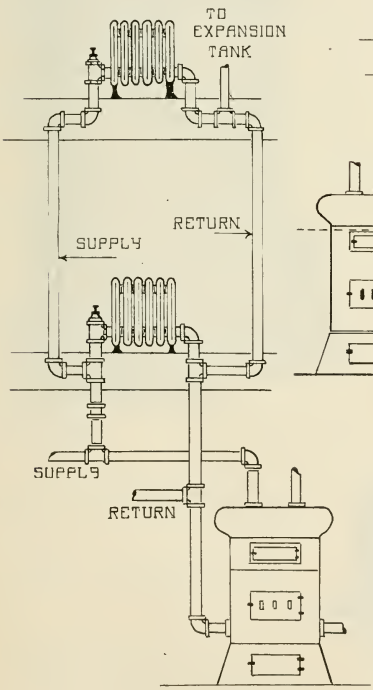


Fig. 98—Steam system of piping.

In taking a supply off the main radiating pipe to go to the radiator, never take it off the top, as this will cause an irregular and uncertain circulation. It must be taken off the side. It will be found that the principal current of heated water will take the path of least resistance and that a small obstruction or irregularity in the piping, is sufficient to interfere generally with the amount of heat received in different parts of the building.

The expansion tank should be placed somewhere above the highest radiator. When water is heated, it expands and the tank should be so placed in order to take care of the increase in volume.

The thorough insulation or covering of all piping on a steam or hot water heating apparatus—as well as the covering of all exterior surfaces of the boiler not occupied by the various pieces of plate work (the clean out, fire, and draught door, etc.) is essential to the economical operations of the apparatus. Tests have often proven that the insulation of such surfaces affect a saving of from 15 to 30 per cent., the amount depending upon the character of the covering applied.

Water rates are based on maintaining 180 degrees water temperature at the boiler.

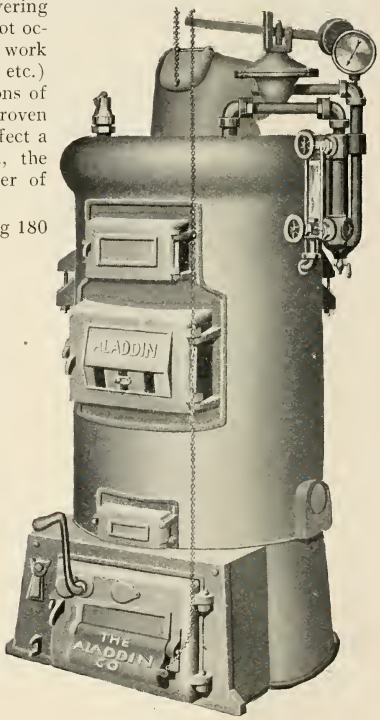


Fig. 99—For hot water heating.

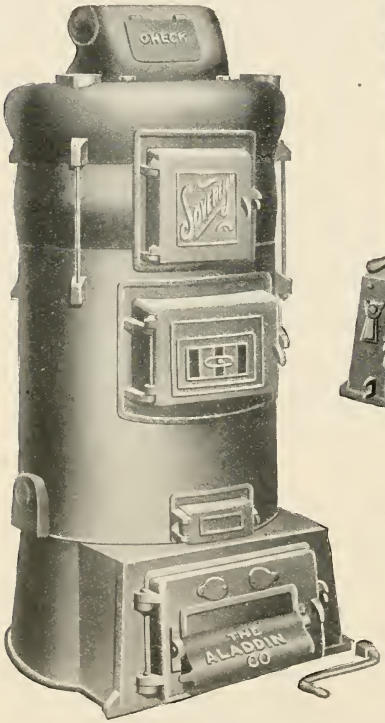


Fig. 100—Steam Boiler.

Radiating surface should be sufficient to maintain a temperature of 70 degrees.

If the boiler is to burn soft coal or if it is located in an extreme end or corner of building, it should be increased one size.

Radiators

Radiators are generally made of iron and may be any shape that will allow a good circulation of steam thru them, and also permit the air to circulate freely about the outside. It is also desirable that the thickness of the metal shall be only enough to give sufficient strength. Hot water radiators have the same appearance as those used for steam, but as a rule there is a slight difference in the interior to improve the circulation.

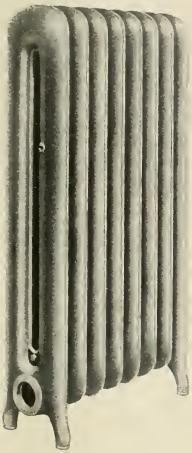


Fig. 101—Two-column radiator.

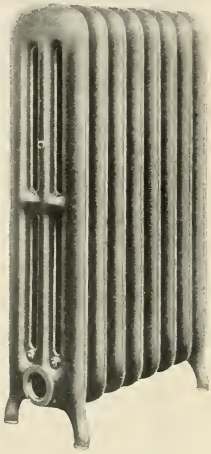


Fig. 102—3-column radiator.

Radiators are divided into three classes, first, direct radiation; second, direct - indirect radiation; and third, indirect radiation.

Direct radiating surfaces embrace all heaters placed within a room or hall to warm the air already in the room.

Indirect radiating surface embraces heating surfaces placed outside the rooms to be heated, and should only be used in connection with some system of ventilation.

Fig. 103—Window radiators.

Direct-indirect radiation is a means between the other two methods. The radiators are placed in the rooms to be heated, as in the first methods and a supply of fresh air brought to them, thru openings in the outside wall of a room, or thru a space under the lower sash of a window.

Radiators are rated, or measured, not according to their size, but according to the amount of heating surface coming in contact with the air. The size of radiators for a given amount of heating surface will depend entirely upon the form or shape of the radiator. They are manufactured in one, two, three and four columns in large varieties.

The following table will give the heating surface per square feet for two and three column radiators.

TABLE XVI
Heating Surface per Sqare Foot, Two Columns

No. of Sections	Length of radiator	45" high 5 sq. ft. per sect.	38" high 4 sq. ft. per sect.	32" high 3⅓ sq. ft. per sect.	18" high 2 sq. ft. per sect.
2	5	10	8	6⅔	4
3	7½	15	12	10	6
4	10	20	16	13⅓	8
5	12½	25	20	16⅔	10
6	15	30	24	20	12
7	17½	35	28	23⅓	14
8	20	40	32	26⅔	16
9	22½	45	36	30	18
10	25	50	40	33⅓	20
11	27½	55	44	36⅔	22
12	30	60	48	40	24
13	32½	65	52	43⅓	26
14	35	70	56	46⅔	28
15	37½	75	60	50	30
16	40	80	64	53⅓	32
17	42½	85	68	56⅔	34
18	45	90	72	60	36
19	47½	95	76	63⅓	38
20	50	100	80	66⅔	40

TABLE XVII
Heating Surface per Square Foot, Three Columns

No. of Sections	Length of Radiator	45" high 6 sq. ft. per sect.	38" high 5 sq. ft. per sect.	32" high 4½ sq. ft. per sect.	18" high 2¾ sq. ft. per sect.
2	5	12	10	9	5½
3	7½	18	15	13½	8¼
4	10	24	20	18	11
5	12½	30	25	22½	13¾
6	15	36	30	27	16½
7	17½	42	35	31½	19¼
8	20	48	40	36	22
9	22½	54	45	40½	24¾
10	25	60	50	45	27½
11	27½	66	55	49½	30¼
12	30	72	60	54	33
13	32½	78	65	58½	35¾
14	35	84	70	63	38½
15	37½	90	75	67½	41¼
16	40	96	80	72	44
17	42½	102	85	76½	46¾
18	45	108	90	81	49½
19	47½	114	95	85½	52½
20	50	120	100	90	55

To determine the amount of radiation necessary for your building many things have to be taken into consideration and no rule given will be authentic in all cases. The best way is to consult a reliable concern and let them figure it out for you. The Aladdin Company will furnish any information desired if you submit a rough sketch of your building and the material from which it is constructed.

First in consideration is the location of building, one built out in the open such as farm houses will naturally take a large heating plant and more radiation than one which is built in the city and sheltered on one or more sides by other buildings.

Second in consideration is the outside wall and glass area of the different rooms; third, the location of heating plant for equal distribution of heat units; fourth, prevailing winds an average low temperature; fifth, purpose of building or rooms.

Hot water radiation will require about 50 per cent. more than radiation for steam.

Steam Heating

THE steam system of heating is very similar to that of hot water, only steam instead of hot water, radiates thru the pipes. The same systems of piping are used with it except that steam pipes do not have to be as large as those used for hot water.

A system of direct steam heating consists of a furnace and boiler for the combustion of fuel and generation of steam, a system of pipes for conveying the steam to the radiator and for returning the water of condensation to the boiler, and radiators or coils placed in the rooms to distribute the heat given off by the steam.

Then a steam heating plant may be divided into three distinct parts; first, the boiler or steam generator; second, the radiators; and third, the supply and return pipe connecting the two.

A boiler used for heating purposes is constructed to carry a low steam pressure of from two to ten pounds and the condensation in the radiator flows back to the boiler by gravity.

The general forms of the radiators used in steam heating are those made up in sections, the number depending upon the amount of heating surface required. These sections are connected at the bottom by special nipples, so that the steam entering on the end fills the bottom of the radiator, and, being lighter than the air, rises thru the loops and forces the air downward and toward the farther end where it is distributed thru an air valve placed about midway of the last section of the radiator.

To get the best results from wall radiators, they should be set out at least 1½ inches from the wall so as to allow a free circulation of air in back of them and should, if possible, be placed in the coldest part of the room as under windows or near doors.

Fig. 98 shows the way of piping a building with a two-pipe system.

Give all pipes a good test before putting them in use and be sure that all threads are well drawn up into their connections.

Do not try to bend a pipe.

Do not use unions on concealed work.

Use adjustable hangers as these will allow the entire line to be drawn a little if necessary.

Be sure that the threads of all connections are well filled with piping lead.

Long-turn or long radius fittings will greatly aid circulation and reduce friction in a system of piping and should be used wherever possible.

A steam main should have a pitch of at least ½ inch for every 10 feet of length and branch off main should have a pitch of 1 inch for every 5 lineal feet. Care should be exercised to secure as near a perfect alignment as possible in the running of pipes, and pockets should be avoided. When absolutely necessary to make a direct rise for the purpose of securing head room or to pass some obstruction, a small bleeder pipe ⅜ inch or ½ inch should be tapped into the lowest point of the pocket there formed in order to cardy off the condensation. A check valve should always be placed in the return, near the boiler when radiators are located near the water level of the boiler. If the water level of the boiler shows a disposition to vary, it may be kept steady by connecting a pipe called an equalizing pipe from the steam dome or top of the boiler to one of the return openings, below the water line of the boiler, or it can be connected to the main near the boiler and tapped into the return pipe near its entrance into the boiler. Check valves should always be located in a horizontal position of the return and as near the boiler as possible.

Branches should be taken from the top of the main, or they may be taken at an angle of 45 degrees. They should be run with a pitch up from main to riser.

Where reductions in size of main are to be made, eccentric connections or couplings should be used. If this is not done, place a drip at each reduction to the wet return.

Main returns for a two-pipe system should increase in size as branch enters it. It should be kept one size smaller than the corresponding supply pipe. When a drip is connected with a dry return, a loop or trap should be inserted to prevent short circuiting of the drain, which would block return water.

Doubling the diameter of pipe increases the capacity four times.

The Boiler

The requirements of an economical and satisfactory working boiler for house heating are as follows:

1. They should contain a quantity of water sufficiently large to fill the pipes and radiators with steam, to any required pressure, without lowering the water in the boiler or require an addition when steam is up, for if the steam should go down suddenly there will be too much water in the boiler. This occurs in boilers made with very small parts, or pipes which have a small capacity at the water line; such boilers require great care, for should the boiler have an automatic water feeder set for the time water line, it will fill up, but cannot discharge again when the steam goes down, while if it has no feeder, there is danger of spoiling the boiler, as the water is in the pipes in the form of steam.

It is true that a boiler which contains a small amount of water in proportion to its heating surface will get up steam quicker, than one containing a large amount, but the latter will hold its steam much better when fire is re-

newed; boilers having a small water capacity are quickly chilled and will have to be fired often.

2. The fire box should be of iron with a water space around it, and should be below the fire door to admit a thick fire to last all night and keep up steam. The fire box should be spacious to allow good combustion of fuel.

The Care of the Furnace

No hard and fast rules can be laid down for the care of every furnace. Furnaces themselves differ and chimney flues vary as to draft, etc. The quality of coal is the third factor to be taken into consideration and the size of coal, the fourth. Allowing for all the differences and assuming that there is a fairly good draft to furnace and a good quality of coal and the proper size being used, the following rules should help insure good results.

Clean all pipes and chimneys every fall. If soft coal or semi-soft is burned, the pipes may need cleaning more frequently. When anthracite or hard coal is used, an annual cleaning should be sufficient.

See that the fire always has a good draft. There is an almost universal idea that a partial draft reduces consumption of coal. This is true, but it also decreases production of heat so that nothing is gained. Unless the draft is unusually strong, as it is in exposed situations in the country, it may be left partly open and the rapidity of consumption regulated by the door below the grate.

The half draft is particularly bad in damp, muggy weather. To burn, fuel requires a certain amount of oxygen; otherwise it smoulders and forms poisonous gases which pass off unburned. Coal gas in a house means a defective draft, so that even in exposed situations, it is better to open the draft wide in damp weather. The occupant of a new house with an unused chimney will have need of all the draft that can be created. New chimneys never draw well. In building fires in furnaces in new houses, all cellar windows should be left open to insure as good a current of air as possible.

To build a new fire, clean the grate, remove all ashes from beneath, open drafts wide and see that the kindling is well started before adding coal. The poorer the coal, the slower it must be added. When the grate shows a bed of red coals, check drafts.

To insure an even, good fire, see that the ash pan is cleaned daily. Never allow ashes to accumulate. Keep a good bed of coals. The best rule is to keep the fire box full constantly. Add coal from two to four times daily, according to the rapidity of consumption. Add very little coal to a low fire. Avoid shaking a low fire severely. Open drafts and defer shaking until the new coal has caught.

The fire desired in moderate weather is one which gives a slow, steady, mild heat. To get this, keep drafts open, but allow an ash deposit to form upon the grate. According to the furnace, this may vary from two to four inches. Add to this a layer of coal but keep the bed deep. Avoid shaking down except at night, and then allow a layer of ashes to remain upon the grate.

In crisp, severely cold weather with high winds, when a maximum heat is desired, keep live coals upon the grate, add coal in large quantities and when burning well, check draft below grate.

To keep the house warm overnight, let the fire be attended to as late as possible. Shake down the grate so that it shows a bed of live coals. Then open the drafts, fill the fire box with coal and shut the door. Then remove all ashes from the ash pan, and during this time, the gases will burn off and the lower door of the firebox may be left open a crack. Enough coal should be added to burn all night and start morning fire without additional filling. A fire cared for in this manner late at night, will keep a house evenly heated in the coldest morning hours, and avoid forcing a hasty fire in the morning.

Aladdin Hot Water Boilers are furnished as follows:

Rating, Water.	Height, Outlet.	Size, Tappings.	Water Line.	Smoke Pipe.	Shipping Weight.
300 ft.	43 in.	2—2½ in.	38 in.	7 in.	500 lbs.
375 ft.	48 in.	2—2½ in.	43 in.	7 in.	535 lbs.
450 ft.	53 in.	2—2½ in.	48 in.	7 in.	550 lbs.
525 ft.	45 in.	2—2½ in.	40 in.	7 in.	600 lbs.
600 ft.	50 in.	2—2½ in.	45 in.	7 in.	800 lbs.
650 ft.	55 in.	2—2½ in.	49 in.	7 in.	900 lbs.
775 ft.	50 in.	2—2½ in.	47 in.	9 in.	1040 lbs.
850 ft.	56 in.	2—2½ in.	53 in.	9 in.	1100 lbs.
950 ft.	62 in.	2—2½ in.	59 in.	9 in.	1200 lbs.
1125 ft.	58 in.	2—3 in.	54 in.	9 in.	1400 lbs.

Aladdin Steam Boilers are furnished as follows:

Rating, Steam.	Height, Outlet.	Size, Tapping.	Water Line.	Smoke Pipe.	Shipping Weight.
175 ft.	43 in.	2—2½ in.	38 in.	7 in.	560 lbs.
225 ft.	48 in.	2—2½ in.	43 in.	7 in.	630 lbs.
275 ft.	53 in.	2—2½ in.	48 in.	7 in.	675 lbs.
325 ft.	45 in.	2—2½ in.	40 in.	7 in.	800 lbs.
375 ft.	50 in.	2—2½ in.	45 in.	7 in.	825 lbs.
425 ft.	55 in.	2—2½ in.	50 in.	7 in.	970 lbs.
475 ft.	50 in.	2—2½ in.	43 in.	9 in.	1100 lbs.
525 ft.	56 in.	2—2½ in.	49 in.	9 in.	1200 lbs.
575 ft.	62 in.	2—2½ in.	55 in.	9 in.	1300 lbs.
650 ft.	58 in.	2—3 in.	52 in.	9 in.	1400 lbs.

Heat Controller Directions

Placing the Controller

IN putting up the Regulator, place the Controller in the room most generally used, about five feet from the floor. Locate Controller on an inside partition not too near an outside wall, a fire grate, hot chimney, hot pipe, register, gas jet, or where it will be subject to drafts of cold air. The most convenient place will usually be found next to a door casing.

The Motor

The motor must stand level, and it can be mounted upon the brackets anywhere convenient to the heater; if possible it ought to be placed so the cranks will travel in line with the chains, to avoid excessive friction; if this is not practical and the cranks must throw at right angle to the chains, then the motor should be at least two feet below the pulleys or the pulley friction will be heavy, owing to the chains being drawn out of line too much.

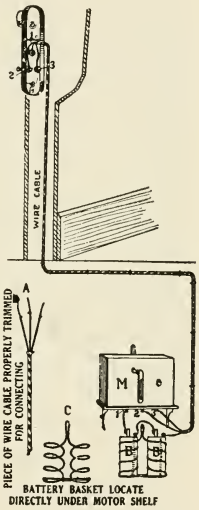


Fig. 104.

Wiring

The wires from back of Controller may be passed through a hole made in the plastering and down through the floor in the following manner. Attach a weight to a firm length of string and pass through hole in wall, where Controller is to be located, allowing weight to drop between plastering to the floor; bore a hole up from the basement and use wire with hook on end to locate string and weight, and pull through to basement. Wind wires together in one strand at the end, and form loop of wire just large enough to pass string through, and draw back up through the floor between the partition and through the hole where Controller is to be located. Or, if more desirable, they may be brought out through the hole in side of Controller base and run along any woodwork to a point more convenient for entering the basement.

Do not allow wires to rest against any metal. All connections should have a clean contact and be firmly made, but the insulations on wires should never be removed further than is absolutely necessary to accomplish the same For if the bare wire touches the metal of Controller or another bare wire it forms a short circuit, causing the motor to run continuously until run down.

Run cable from back of Controller connecting wires to posts 1, 2, 3, (see Fig. 104), to battery located directly beneath motor, connecting same colored wire to zinc of one cell as connected to post 1 of Controller, then another wire from carbon of same cell to zinc of second cell, and another wire from the

remaining carbon to post 1 of Motor. Run wires from post 2 and 3 of Controller to post 2 and 3 of Motor.

Adjusting the Controller

After Regulator has been applied wind the Motor clear up and adjust the Controller as follows: Turn the knob on Controller until indicator points to figures on scale corresponding to the degrees of temperature indicated by the thermometer, lossen the jam screws, screw back the contact points a considerable distance so they will not touch the metal strip, hang a thermometer up close by the Controller, and allow it time—say ten minutes—to correctly indicate the temperature. Press strip against left hand contact point to be sure of contact on cold side for three or four seconds and then let go the strip, screw the right hand point forward very slowly until contact is made with the strip and the Motor starts, but no further. Turn indicator two degrees above the temperature and screw in the left hand point to a contact in the same manner and Motor starts. Then tighten the jam screws to prevent the points from changing. Neither point should be screwed in so far as to jam the strip against the other one, as it injures the contact surfaces and causes Motor to continue running. While this is being done do not allow the indicator or pointer to move, nor breathe on or handle the Controller unnecessarily, as it is very sensitive. After the adjustment is made, it is well to allow the instrument to again settle to the correct temperature, when the adjustment should be proved by moving the pointer either way slowly to note that when turning pointer toward the left it starts the Motor (closing dampers) when arriving at the figures corresponding with those indicated by the thermometer, and when turning pointer toward the right to operate the Motor at a point two degrees above the temperature (opening dampers). This is the proper test to be used at any time, when necessary, to demonstrate that the Controller is in proper order, but of course the Motor must always be wound up at such time, as it contains an automatic circuit opener and when Motor is nearly run down the line is thrown open permanently to prevent polarizing the Battery. As the line is thus opened the Controller is rendered inoperative, until the Motor is wound up again to close circuit at that point.

If the Controller should fail to act, all the work must be carefully inspected from beginning to end in search of an error as it never fails to work if properly connected.

After the Regulator is in working order, set the Controller for the degree of temperature desired and let it alone. Turning the indicator to the highest degree on the scale when the room is cold, or to its lowest degree when hot, will not produce heat or cold any quicker than moving the indicator one or two degrees higher or lower than the temperature of the room. The draft will be opened or closed just as wide in one case as the other.

Adjusting the Motor Cranks

After proving the adjustment of the Controller turn the indicator up scale to the extreme above the temperature of the room, wind the Motor and adjust the crank as follows: Put crank on Motor with arm pointing up. Run chain from crank arm to front damper, this will give you the right length of chain, then reverse the crank arm and this will hold your front damper open

as called for by controller, connect chain to remaining crank arm with arm pointing up and check draft closed and leave in that position. Then turn pointer of Controller five degrees below temperature and front damper should be closed and check damper opened. Set the sliding pins in crank arm as near the hub as consistent to obtain the proper opening to dampers, which will enable the Motor to exert more power in pulling chains.

Do not attempt to operate old rusty and corroded dampers which do not work easily.

Automatic Stop Dampers Closed

The Motor is provided with an automatic check, which causes the cranks to always stop in the same position when Motor is run down. To find this position make a connection between Motor posts 2 and 3 and allow the Motor to run until it automatically checks, and this will be the way it will always stop.

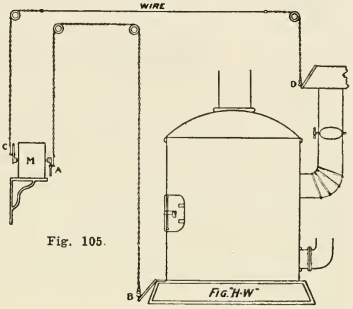


Fig. 105.

Hot Water Heaters

Fig. 105 shows the plan for connecting to house hot water boiler. Allow front draft to open very little and usually not more than one-half inch. Give check on pipe full opening. Run chains from "A" to "B" and from "C" to "D." Some experimenting is necessary in order to determine how much the check damper and draught door should be opened. If the temperature runs by after the damper is closed, decrease the amount of the opening in the front draft and increase the check draft opening. Over half the trouble with Controllers is due to neglect in observing the above points. Connect Hot Air Furnace in same manner as Hot Water.

Steam Heaters in Conjunction with Diaphragms

The best plan for connecting to house heating steam boiler is shown in Fig. 106. The letter "H" shows a common awning pulley connected to top of piece of chain from front draft "B." Run chain from the motor crank "A" over pulleys to pulley "H" and through sheaves up to the end of diaphragm lever "E" and connect to it at that point. Run another chain from motor crank "C" and connect to check damper at "D." Run

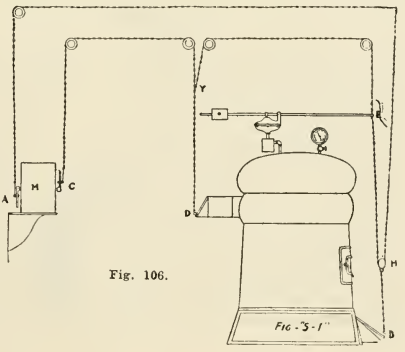


Fig. 106.

another chain from end of diaphragm lever at "E" over pulley and connect at "Y." This arrangement enables the diaphragm and Controller to work in harmony producing the best possible results as follows: When the temperature of the house rises above the desired degree (when pointer is set) the motor "M" at once pulls the check damper "D" open and lengthens the draft chain "A-E," closing the front draft damper. As long as the temperature of the house stays at this point, it is impossible for the diaphragm to close the check "D" or open the front draft "B." When the pressure of steam depresses the end of the diaphragm lever it will lengthen the chain "A-E" and close front draft and pull on chain "E-Y" and open the check.

Management of Fire

Shake the grate very little in mild weather and burn the coal over quite a depth of ashes; this will give a mild heat and save fuel. As the weather becomes steadily cold keep grate reasonably clear by shaking, and the furnace well filled with coal. When filling the furnace with coal see that the Controller is set so that the front draft under the grate will be held open, otherwise the furnace will be liable to throw out gas.

When out-door temperature is at zero or lower, wind the motor twice a week and when above that point wind weekly.

Cleaning Contacts of Controllers

When the fire is started up in the fall, draw a piece of thin paper through between each contact point and the blade of the Controller to remove any substance that may have accumulated and the Regulator will be ready again for the season.

Caution

To avoid injuring the Motor or getting an erroneous idea as to its action do not attempt in any way to start it except by turning the knob of the Controller. Letters are frequently received from people who trip the Motor by some other means, stating that the "Motor does not stop upon one-half revolution of the crank shaft," and requesting an explanation or remedy. If the Regulator is allowed to act automatically or an action be forced by turning the knob of the Controller only until the pointer passes the temperature point to get the electric contact, the proper action will be produced. Do not shift the Controller pointer except when it is absolutely necessary. The Regulator is self-acting or automatic, and will operate every time the temperature ascends to or drops two degrees below the point at which the Controller is set.

Fig. 107 — Shows Thermostat with clock attachment.

Motor Running Down

Should a Motor fail to stop until entirely run down, a cross somewhere between the wires (described in Fig. 104 as running "from posts No. 2 and No. 3") can be found or the contact points of Controller are both touching the blade.

These wires at Motor or Controller cannot touch any metal except the posts to which they are connected, or the blade of Controller have contact with both points at once, or the electric current will continue to flow and keep the Motor running until it opens the line.

Note—Do not strip insulation too far back on wires where connected to back of Controller. If bare wires touch each other or base of Controller, the Motor will run down. This sometimes occurs when pointer is turned up or down, causing wires to crowd and touch each other or base of Controller.

Important Suggestions

Leave open constantly all doors or passageways between the rooms to be controlled, so the air can freely circulate.

Do not entertain the idea that because a thermometer in another room does not agree exactly with one by which the Controller was adjusted, or because you feel warm or cool, the Regulator necessarily is not working, but when in doubt from any cause, just step to the Controller and observe whether the mercury register or temperature corresponds to the figures indicated by the Controller pointer. If so, all is well. If the temperature is found to be above the pointer and the front draft door is closed, or below it and the draft is open, the Regulator is not at fault, unless, after the Motor has been wound, it will not operate when the pointer is shifted each side of the temperature point sufficiently to make the contacts. Do not move pointer after you have Controller working satisfactorily, keep it in the same position day and night.

If the Motor operates at the temperature point when the pointer is being turned down the scale and again when it is turned two degrees above the temperature point, the Controller is properly adjusted and the Regulator in working order.

When the Regulator is in such working condition as described and, after front draft has been closed, the temperature rises or carries by, do not shake grate too much, but allow the ashes to remain in the coal. If the temperature does not rise the two degrees required after front door has been open two hours, free the grate a little more. By carefully experimenting in this manner a few days, any one can fire so a heater will require attention but once or twice each day.

Plumbing

THE plumbing of a building marks a very important step in its construction, and must be installed in the proper manner in order to have proper ventilation and drainage, which is necessary in order to make it healthy to live in. In most cities, the plumbing work is governed by the building code issued by the city building department, and is also inspected and passed or condemned by a city plumbing inspector before the builder is given a permit for service by the city department. Even though the work is to be installed by an experienced plumber, there are many things which the builder should inspect and be sure are done correctly. We will give such information as we think will be of value to our builders, on plumbing, avoiding as much as possible, the use of technical terms that might tend to confuse the mind of the average workman.

There is not an item entering into the construction of a building of such vital importance to the occupants as the plumbing installation; poor workmanship, improper or imperfect materials, or faulty fixtures, any one or all of these may be present, permitting insidious, poisonous gases to permeate the house, breeding malaria, typhoid and other diseases, ending often in the death of one or more members of the family before the trouble is detected and corrected.

The builder should reserve for plumber, a well worded contract or letter of specifications stating exactly what is to be done and the kind of materials to be used. The following is an example of worded specifications and contract between plumber and builder for the installation of a small outfit for an ordinary house.

Form of Contract and Specifications Between Owner and Plumber

Bay City, Mich.,
Jan. 25, 1918.

An agreement entered into this 25th day of January, 1918, between John Smith of Bay City, Mich., as owner and party of the first part, and the Bay City Plumbing Co., also of Bay City, Mich., as contractors and party of the second part.

The said party of the second part, for and in consideration of the sum of One Hundred Thirty-Eight Dollars and Fifty Cents, ($138.50) in payment, to amount to the valuation of the work satisfactorily completed and in place at date of payment, does hereby propose and agrees to furnish all labor and material necessary to do the plumbing in the John Smith Bungalow on 4th Ave., specified as follows:

Beginning where sewer enters basement, place a 4 inch double hand hole running trap. On inside opening of trap, calk in a 4 inch brass cover

cleanout. In other opening of the trap, run 4 inch soil pipe out thru side of house above grade, placing a vent cap on same for fresh air inlet. From end of trap run over to partition under bathroom and up thru house and roof, flashing with galvanized iron flashing making roof water tight where soil pipe passes thru same. Use all the necessary ties and branches to receive the plumbing fixtures which are to be installed.

Place in the basement floor one 9 inch cess pool properly connected to the sewer; place in the kitchen one 20x30 white enameled Aladdin sink, sink to have finished brass faucets for hot and cold water connections. Sink to be connected to sewer with a continuous waste pipe running up thru roof and flashed with a galvanized iron flashing making roof water tight where vent pipe passes thru same.

Place in bathroom on first floor one 5 foot white enameled Aladdin bath tub, tub to have nickel plated faucets with china index top, nickel plated supply pipes and nickel plated waste and overflow to the floor. Also place in bathroom one 18x21 white enameled Aladdin lavatory with D shaped bowl, lavatory to have nickel plated faucets with china indexed top, nickel plated waste and overflow and nickel plated supply pipe to the floor.

Also place in bathroom one Syphon wash down Aladdin closet with golden oak tank and seat and nickel plated supply pipe to the floor. Place in bathroom floor one 4x8 inch down trap (lead) with nickel plated cover set flush with finished floor of bathroom. Place one ¼ inch lead waste pipe from trap under floor and connect with tub and one ¼ inch lead pipe from trap to sewer. Run one ¼ inch galvanized iron vent pipe from trap 5 ft. above floor and connect with vent pipe for venting tub. Place one ¼ inch nickel plated vented S trap under lavatory and connect to sewer with one ¼ inch lead pipe. Run one ¼ inch vent pipe from trap and connect with vent pipe in wall.

Plumbing to include all necessary water connections to supply sink and bathroom with hot and cold water. Hot water pipe to run to furnace and to connect with heating coil which is to be included in same. It also includes two nickel plated soil cocks to be placed one at front and one at back of building. Water pipes to have all necessary waste cocks and shutoffs.

A forty gallon range boiler is to be placed where desired and necessary connections made to same for supply for hot water pipes.

All work put in complete and in a first class workmanlike manner.

(Signed) Bay City Plumbing Co.,
Per E. C. Rock.

Witnesses:

In this book we will endeavor to explain in as simple a manner as possible, the valuation of the plumbing in an average home in which a closet, lavatory, bath tub, kitchen sink and laundry tub are installed:

We have also shown several plumbing layouts illustrating the above fixtures in a sanitary, substantial manner.

The system commonly known as the "revent system" is generally specified in plumbing contracts as this system will overcome any possibility of breaking the water seal which sets in the different fixture traps and causes a siphonage, back air or gas pressure when flushing any one of the fixtures. This system is highly recommended and gives good results, but the "non-revent system" will also give very satisfactory results under ordinary circumstances, and is much cheaper to install.

Drain Pipe and Sewer

Certain terms are applied to different parts of the piping system of a plumbing installation, some though they may be connected together into one continuous line; this becomes necessary, in order that the different sections shall be properly designated.

The house sewer is that part of the main drain pipe, or sewer line, extending from a point about two feet from the outer house wall, to the street sewer, or cesspool, as the case may be; the house drain is the main horizontal line extending from the vertical soil line to the house sewer. The fresh air inlet is a line of pipe of same diameter as the house drain extending from a point outside the outer wall about one foot above grade, and about ten feet from the nearest window, or other opening into the house, where it is surmounted with a return bend, or some patented air inlet device to a connection on the house drain just inside of the main house trap, and is intended to provide fresh air for the ventilation of the drainage system. The end of the fresh air inlet should never terminate in a so-called street box, a metal box placed at the street level, usually near the curb, and covered with a metal grating; the box soon becomes filled with dirt, the grating often broken, and the air inlet absolutely inoperative.

The soil line is the line to which the water closets are connected. It is extended thru the roof, and above the last fixture becomes a vent line. The waste line is the one to which the waste lavatories, bath tubs, sinks and wash tubs is connected, and it in turn is connected to the soil line, if its termination is above the first floor, or to the house drain if at the lower floor. The waste line is not always a vertical line, it usually connects at each floor to the soil line. The vent line is a vertical line extending as a loop from its connection to the house drain below the lowest fixture, to its connection to the soil line above the highest fixture; to this line the back vents are connected from the various fixtures. If there are no plumbing fixtures above the first floor, this line becomes unnecessary and may be omitted, but if there are water closets in the house, the soil line must be extended full size thru the roof. Where no water closets are installed in the house, only such fixtures as lavatories, sinks, etc., the vent line, if such is used, or its equivalent, the waste line must be extended thru the roof enlarged not less than twelve inches below the roof, to four inches in diameter, and extending at least four feet above the roof. Under no circumstances should the termination of this soil, or vent line, be placed near, or in line with any window or other opening into the house, nor should it be placed near a chimney, as the poisonous gases discharging from the vent pipe are very likely to be carried down the chimney poisoning the air in the rooms, when the chimney is not in use. No cowl, bend, or covering of any kind should be placed over the top of the vent line.

The vent line is intended to ventilate the drainage system, and to prevent breaking of the seals in the traps by syphonic action. Its proper installation is therefore most important. If it is extended thru the roof of less diameter than four inches, it will not be of sufficient area to answer the purpose, and in winter will almost surely be entirely closed by hoar frost. The writer has seen country houses with the vent line carried two inches in diameter a short distance above the roof, surmounted by a short increaser to four inches in diameter, presenting the appearance of a funnel, and making an excellent receptacle for leaves, birds' nests, etc., utterly defeating the object for which it was intended.

About the first thing to be considered and one of very much importance is the sewer. It is usually constructed of vitrified tile pipe from the main sewer of the street up to a point inside foundation wall. When the sewer is being laid, the builder should be sure that the joints of the pipe are well connected and that they are well swabbed out so that no waste matter can catch on the cement which may have worked its way thru the joints of the pipe and hardened on the inside.

The sewer should be laid with a good decline from the house toward the main sewer of the street and carried well below the cellar floor so as to prevent any "backing up" in rainy weather. But also be careful that the sewer does not get too much of a decline, as the water travel will be so rapid that the water will run ahead of the solid matter. The pitch should be about one-fourth of an inch to each running foot.

The sewer pipes on the inside of the foundation should be of iron and of sufficient size to carry off all waste matter. Place a cleanout on the inside of the foundation and have a vent cap in the same for fresh air inlet. All Y's and T's used in sewer connections should be well calked and given a good water test before put in use. Connections should be provided in sewer to carry off all water from the draintile under foundation, conductor pipes, from eaves and cistern overflows. The cistern overflows should be so connected that there will be absolutely no danger of the sewer "backing up" into the cistern.

There is no hidden force in the sewer pipes to keep carrying away the sewerage, and solid matter requires a force of water to dispose of it. Therefore, if a 5 inch pipe is large enough, do not use a 6 inch, for the same amount of water will be deeper in a 5 inch pipe and will have a better force to carry off the solid matter.

If the house is situated in a low lying district, where the sewer is likely to overflow during a heavy rainfall, or if the house sewer discharges into a river, a lake, the sea, or any body of water affected by tides or freshets, a flap valve should be installed near the end of the house sewer to prevent the sewage from backing up into the house. In such cases the house sewer should be graded one-half inch per foot, to secure a flow sufficiently rapid to carry paper and sludge past the valve without clogging it.

Be sure that good joints are made between the clay pipe and iron pipe, as leaky joints are a menace to the health of the occupants. The floor of the cellar should contain a cess pool properly connected with the sewer so as to carry off any water that may collect there, thus insuring a dry cellar. Dampness is the chief enemy of mankind. Where there is dampness, there is decay;

where there is decay, there is disease; and where there is disease, there is death. Eliminate dampness and fully over half the ills that flesh falls heir to will disappear.

Three and four inch sewer tile costs 12c per lineal foot and five and six inch will cost about 18c per lineal foot.

Ventilation

All sinks, washstands, bath tubs and closets should be well ventilated by vent pipes running up thru roof. The kitchen sink should be connected with the sewer with a conductor waste pipe and should have a vent pipe running up thru the roof and flashed with a galvanized iron flashing or patent flashing which will prevent the roof from leaking where the pipe passes thru same.

The lavatory, bath tub and closet should all have vent pipes running up thru roof and flashed in proper manner.

A four inch soil pipe connection is usually brought into the building from sewer pipes and is carried over to a point which is most convenient for all connections and is then carried up thru roof for ventilation with the necessary Y's and T's placed in same to take care of other fixtures. The main soil pipe should have a vent pipe running up to grade at the point where it enters the building, same should be fitted with patent cover so line will not become clogged up.

A two inch soil pipe is used for receiving the waste from plumbing fixtures other than the closet and for ventilating purposes and the four inch soil pipe for receiving the waste from plumbing fixtures including closet, also for underground sewer line inside building.

It is always a good plan to place a stack increaser on the vent pipes which go up thru the roof, as moisture rising from stack in cold weather freezes in the form of hoar frost on inside at top of stack and prevents proper air circulation unless increaser is used. The adjustable roof flange will give the same results as an increaser.

In soil pipes or stacks at any point where stoppage is liable to occur should be placed a clean-out Y with brass screw cover. By unscrewing cover, pipe can be rodded or cleaned out.

Traps should be placed in the drain pipe of all fixtures whether made of cast iron, lead or brass; all serve the same purpose.

They are so constructed that sufficient waste remains in the trap at all times to entirely close the opening, that is, seal it, preventing sewer gas from backing up thru the waste pipe and coming out of the fixtures into the room.

The kitchen sink should be furnished with a grease trap. If it is not, the pipe is apt to become choked with grease and must ultimately be opened and cleaned by hand, often at material expense when long lines are deep underground. To avoid this, many traps have been designed to separate and collect the grease either by flotation or by chilling, generally by the former.

Traps to collect the grease by flotation were formerly improvised by the plumber and were placed in the drain pipe just outside the foundation. This location of trap left too much pipe subject to choking between the grease trap

and sink. The grease traps now commonly furnished are placed in the kitchen under the sink and frequently serve as a regular trap for the fixture. The grease is easily removed by lifting out the container or by skimming from the top. Hinged bolts with thumb-nuts secure the covers so they can be easily and quickly opened and closed.

Water Supply

The water main is usually tapped and brought into the building and meter placed by the local water company. Kinds of pipes used are generally governed by local building codes.

The iron pipe which is to run into the building should not be connected directly with the coil in water main. A short piece of lead pipe should be used to make the connection, as this will give, and prevent the setting of the earth from breaking off the iron pipe.

The water service pipe should be laid below the frost line and should be carried as directly as possible to the building. Where it enters the building, it should be fitted with a good serviceable stop and waste cock so that the water can be shut off easily in case of leaks, bursting of pipes, etc.

The water pipes are to be put in and plumbing tested out before plaster has been put on building, so as not to damage walls, should there be any leaks.

After the pipes have the shut-off on the inside of the walls, they should run up underneath the joists, being held in place by hangers so that they will not sag. Make proper connections to connect with bath tub, lavatory, closet, sink, slop sink and hot water boiler. These connections should be made to carry the hot water to the different fixtures in the building. Do not use lead pipe for hot water.

After the job has been roughed in, and before it has been covered up and fixtures installed, it should be thoroughly tested in order to do away with any tearing up of floors or removal of plaster to locate and repair leaks which may show up after the fixtures have been set. This is usually done by a water test as any defects in material or leaks in joints will be readily detected when the system is filled with water. All openings should be plugged up and the testing done slowly and any leak found, fixed immediately. All joints should be well leaded and drawn up. Galvanized pipe has been used with the best results for water supply.

Always begin the water pipe supply in basement and work up to fixtures. Allow sufficient fall to all horizontal piping to insure a thorough drain back to basement when the stop and waste cock at the source of supply are closed.

Be very careful to see that no traps are allowed in any horizontal runs of pipe. A trap is caused by the pipe sagging in the wrong direction. This keeps part of the water from returning to basement and is apt to freeze should the house be kept without heat during cold weather.

Run the supply pipes to fixtures with as few turns and fittings as possible. Every turn and fitting means a certain amount of pressure lost by friction.

The pipe generally used to supply water to plumbing fixtures is ¾ inch in diameter. From the supply pipe, branches are run to the different fixtures and T connections made with side openings required by fixture.

It is generally customary to use the ¾ inch supply as far as laundry tub and sink and then extend up or over the bathroom with ½ inch pipe. The connection to be made as follows: Laundry tub and sink, ¾ or ½ inch pipe, the closet tank ⅜ inch, the lavatory ⅜ inch and the bath tub ½ inch.

Installing

In the piping of a plumbing system, three materials enter largely into the construction, and they are cast iron, galvanized wrought iron, and lead. Brass pipe makes a somewhat more durable, and a very nice job, but its high first cost makes its use very rare; next in desirability and in cost comes galvanized wrought iron, but that too is too high in cost for general use on the drainage system, and its use is therefore usually restricted to the water supply, and perhaps a few short waste and vent connections from the fixtures to the main cast iron stacks; but even in these cases lead is more generally used, largely because of the ease of handling. Cast iron, consequently, is left as the most universally used of all materials in the installation of a plumbing drainage system. No earthenware or tile of any kind should be used inside a building in connection with a drainage system. It is too liable to fracture, and is likely to be carelessly installed.

The operation of calking soil pipe joints is very simple and does not require any experience in order to obtain good results. By using the proper amount of oakum and packing it well into the hub of the pipe with lead and calking it, a solid joint can be made. After placing the pieces of pipe into the hub of the piece to which it is to be joined, place sufficient oakum into the joint to make a good foundation for lead to rest upon. The oakum should be packed down solid into the joint. Heat your lead sufficiently to run entirely around the hub before becoming solid. Pour lead into joint as quickly as possible. After it has cooled and become solid, calk it in place.

When pipes are being fitted in horizontally, an asbestos lead joint runner should be used to prevent the lead from running out at the bottom. Until recently, putty, or a rope coated with wet clay was used for this purpose, but now an asbestos lead joint runner is put on the market, which is not affected by the heat, and lead may be poured into joints as fast as runner can be removed.

The best joint is made by pouring in only part of the lead and after calking it down solid, putting in the remainder, calking it but lightly.

Never plunge a cold ladle of water into a pot of hot lead because the great difference in temperature will cause the metal to explode and fly in all directions.

For flashing around the vent stack where it comes thru the roof, lead pipe or seamless drawn copper tubing a little larger than the outside diameter of the stack hub should be used, soldered to a flange of the same material extending about ten inches beyond the pipe on all sides; this flange should be carefully soldered to a metal roof, or laid under the courses of a shingle, slate, tar or other similar roof. The section of vent stack to which the flashing is to be made, should extend about 15 to 18 inches above the roof, the hole thru the roof made as large as the outside diameter of the pipe hub; the lead or copper tubing is then placed in position, and it must be long enough to rise about 2 inches above the vent stack; the flashing is secured to the roof by solder, or

large headed tacks and the end of the tubing turned into the hub of the vent stack; a section of cast iron soil pipe of proper length is then calked into the hub of the vent stack with oakum and molten lead, the same as the joints below the roof are made. This makes a good water tight job, and has a tendency to protect the vent stack from frost.

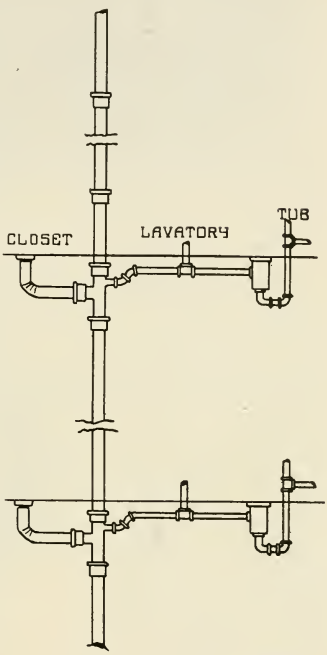


Fig. 108—Non-revent system of plumbing.

Where it can be avoided, plumbing pipes should not be run between the ceiling and floor above; it is next to impossible to get the proper grade, and if any stoppage occurs, or repairs become necessary from any cause, it makes a troublesome and expensive job, and is very likely to ruin the ceiling below. It is better to run the pipes vertically in, at the side wall, or in a partition, and connect to the house drain in the cellar; this applies of course, to where fixtures are placed on opposite sides of the building. For this reason it is a good plan, when designing the building to have the bathrooms or toilets on the upper floors, directly over those on the floor below. It is far more economical and more satisfactory in every respect. In moderately large houses where lavatories are placed in inner rooms, or in large rooms away from the side walls, it becomes necessary to carry the waste pipe under the floor, but the horizontal run should be well and evenly graded away from the fixture, be as short as possible and securely held in place. Always bear in mind that every fixture in the house must be provided with a trap placed as close to it as possible, and with proper ventilation. Where wash tubs and a sink, or basin adjoin each other, it is all right to have the tubs discharge thru the sink trap, but the connection must be made to the trap below the water seal and to the inner, or house side of the trap.

The branch vent connection should be made to the waste pipe, with fixtures other than water closets, and these should be made to the soil pipe about 18 inches from the closet, and only to the upper side of the pipe. If connected at the side, it is liable to be become clogged up, particularly with the soil pipe. It has been the general rule in the past to make the vent connection for waterclosets as near the closets as possible, and for other fixtures, to the crown of the trap, or very near to it. This is a bad practice in both cases. When placed at the crown of the trap, evaporation of the water

seal is increased, and in that location or near it, the splash when the fixture is flushed, will carry grease, paper, lint and other light articles into the vent opening, completely choking it up in a short time, rendering it absolutely ineffective. It is a safe rule to make this connection about 6 or 8 inches from the trap for smaller fixtures, and about 12 to 18 inches for water closets. The branch vent must connect to the main vent stack above the fixture to insure that it shall never become a waste pipe in case the proper waste or soil pipe should become temporarily stopped up. The overflow pipes from all fixtures must be connected to the inner or house side of traps to insure protection against sewer gas.

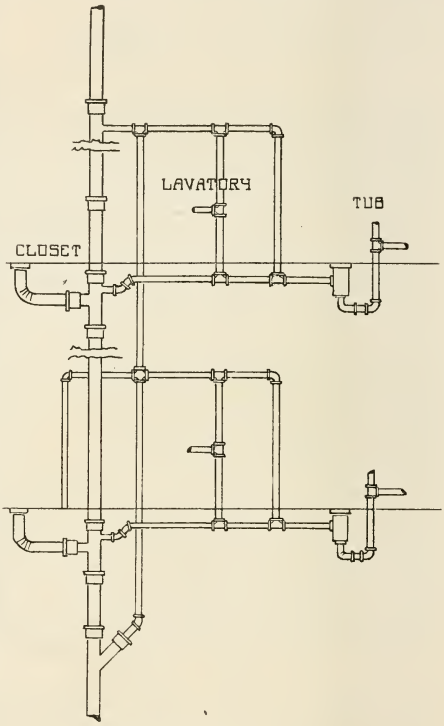


Fig. 109—Revent system of plumbing.

It is impossible by a few illustrations, to explain the method of installing plumbing fixtures under all conditions. The "roughing in" and supply piping of course will be different according to the location of the fixtures and their respective position to each other.

The layouts which we show in these pages are good examples of average one and two story houses. They indicate the locating of the fixture and the running of the pipes so as to use the least number of bends and turns. Run all your piping in as straight as possible.

Complete detailed blue prints and instructions are furnished with all plumbing outfits furnished by this Company.

Non-Revent System

Fig. 108 shows a bathroom outfit consisting of lavatory, tub and closet with connections to a 4 inch soil pipe. This method of plumbing, although used considerably, does not allow for reventing your fixtures. Fig. 109 shows the same layout with revent pipe in place.

If all the fixtures are to located on the first floor. the pipe vent and length of soil pipe are placed on cleats sufficiently below the floor to allow for a T branch into the hub of the soil pipe and still keep the top of the branch on a level with the floor line. From the top of the T branch, the soil stack is continued up to the roof by calking one length into the other. The stack is brought to within a foot or so of the roof and an increaser is calked into it, which makes the inside of the stack larger where it passes thru the roof and prevents the stack from freezing and promotes the proper circulation of air. Where the stack passes thru roof, it should be flashed with galvanized iron flashing to make a water-tight job.

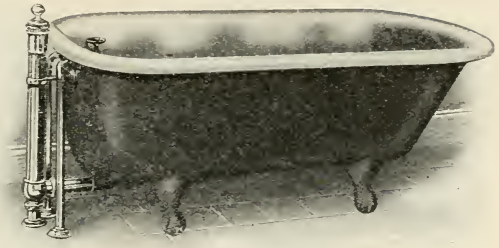


Fig. 110—Roll rim cast iron porcelain enameled tub.

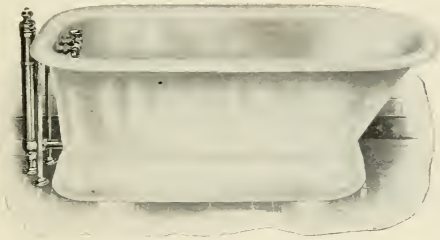


Fig. 111—Roll rim cast iron tub with base.

Into the 4 inch opening of the branch, a closet bend should be calked. The end of the bend should come on a level with the finished floor line.

Fig. 112—Corner Lavatory.

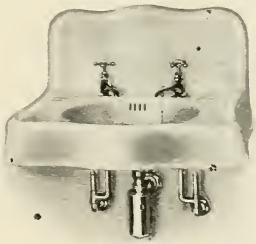


Fig. 113—Wall Lavatory.

Over the end of the bend, a collar is screwed with a calked lead joint and is held firmly in place. Putty is then packed on and around the collar and

Fig. 114—Pedestal Lavatory.

Fig. 115—Closet Combination, wood tank.

the closet bowl is set in place. Enough soft putty should be placed around collar to make a tight connection between the spud of the closet bowl and the bend, but be careful that no putty drops into the bend.

The lavatory should be fastened to the wall by means of a concealed wall hanger. This hanger is first securely fastened to grounds on wall and then fixtures hung in place.

As the bath tub has no trap, it is necessary to provide a seal of some kind to prevent sewer gas from backing up into the room. A draw trap should be placed in the waste line as near the tub as possible.

Fig. 116—Closet Combination with china tank.

Revent System

Illustration, Fig. 109 shows a bathroom outfit with the same layout as Fig. 108, but it has a revent connected to the 4 inch soil stack and doubly insures the water seal in the traps from being broken when bath tub and lavatory are emptied and closet flushed. Where it is impossible to run vent pipe between the walls over to the soil stack on account of windows or doors, the T branch can be placed in attic for revent connection.

Fig. 109 shows a bathroom outfit on first and second floor with revent system. You will notice that each revent is placed so that emptying or flushing one fixture will not affect any of the others regardless of the amount of water which passes thru pipes.

When installing a bathroom outfit on both first and second floors, it is necessary to run a

second revent from a Y branch in the soil stack below the sanitary T for the first floor outfit. This revent is connected to the first revent by a cross.

Fig. 117—Kitchen sink with attached drain.

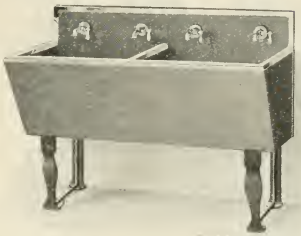


Fig. 118—Two compartment laundry sink.

When a kitchen sink alone is connected with the soil stack, it is not necessary to revent it as the stack itself takes the place of a revent.

The soil stack of all fixtures except closet can be 2 inches, but the closet stack wants to be a continuation of the main soil without any reducers.

The 2 inch soil stack is to be installed in the same manner as main soil, that is, with an increaser where it passes thru roof.

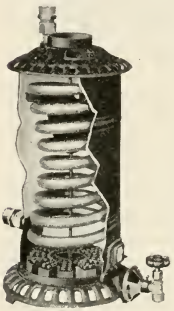
The sink is placed on concealed wall brackets, ordinary sink boards or sink legs, depending on style used. The top of sink should be placed from 2 ft. 6 in. to 3 ft. from floor.

Fig. 119—Cast iron porcelain enameled laundry tub.

Where the kitchen sink is located on the first or second floor and the laundry tub in basement, it is best to revent the laundry tub. Otherwise, the water poured into the sink will be apt to first blow the air and gases in the soil stack thru the laundry tub connections in the stack syphon or suck the water out of the trap.

Hot Water Heater

IN houses that have been piped with gas for lighting or cooking purposes, it is a good plan to install a gas hot water heater either automatic or in connection with the range boiler. During the summer months when the furnace is not in use, and the range boiler has a furnace connection, it is very inconvenient to secure hot water for bath and kitchen use.



Fing. 120—Single copper coil heater.

These gas water heaters are constructed in different sizes according to the requirements of your building, and can be installed in your house during the course of construction at a very small additional cost. Fig. 120 shows a single copper coil of the hour glass type. Fig. 121 shows a double coil heater. Either of these heaters will work out very satisfactorily in connection with a 30 gal. range boiler.

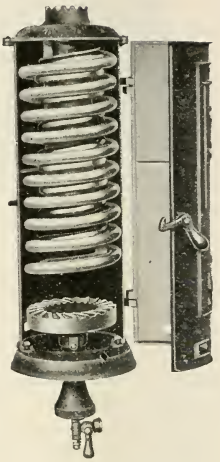


Fig. 121—Double copper coil gas water heater.

Eave-Troughing

IN most instances, the simplest method of taking care of the water from the roof, is to place a galvanized metal gutter under the outer edge. There are many different eave troughs and hangers on the market. The thickness of the metal is standardized for all the different sections and parts. In some places where there are no shops for making gutters, tin or wooden gutters are often used.

Fig. 122—Slip joint of eave trough.

Eave - troughing is made with two different joints, slip joints and lap joints. The slip joint is most satisfactory and much easier to apply, as it can be put together without soldering. The eave-troughing is furnished in 10 ft. lengths and will have to be cut on the job to fit. The water from the eave is usually conducted to a wooden or cement reservoir to be used for domestic purposes, or is conducted

into sewer or drainage system. The trough must be placed on building with sufficient pitch to cause the water to flow to the down spout or conductor pipes. The slip joints of each length should be laid so that the water will run over each joint. See Fig. 122. If this was not done a certain amount of water would work thru the joint. In ordering eave-troughing with slip joint you must state if you want it furnished right or left hand, so the joints can be laid properly. The standard sizes furnished are in 3½, 4, 5 and 6 inch widths, and weigh from 4½ to 7 pounds per foot.

No. 1 No. 2 No. 3

Fig. 123—Galvanized elbows.

Fig. 124—Rain water cut-off.

The house drain, and all horizontal pipes, including the header connection, must be evenly graded not less than ¼ inch per foot; ½ inch per foot is better as that will increase the capacity of pipe 50 per cent., due to the more rapid flow; for instance, a four inch horizontal header connection, if graded ¼ inch per foot would drain 3,000 sq. ft. of roof surface with a moderately heavy rain fall; if graded ½ inch it would drain 4,500 sq. ft.

In localities having a heavy rainfall, it is better to grade ½ inch per foot, or use a size larger pipe than with the ¼ inch grade, but never use a main header less than 3 inches in diameter, or a house sewer or drain less than 4 inches in diameter. A safe rule to follow for size of header, is to allow 1 sq. inch of pipe area for each 250 sq. ft. of roof area.

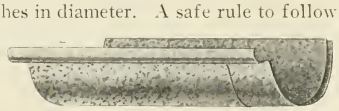


Fig. 125—Galvanized eave trough slip joint.

In ordering the corners it is always necessary to state whether they are to have inside or outside bead and if they are right or left hand. On the end of each run of trough a cap is placed to complete the trough. Drop outlets are also placed in the runs of trough which are pieces of trough about 6 or 8 inches long with an outlet soldered in the under side to connect with the conductor pipe. The conductor pipes are corrugated to prevent bursting if they are frozen full of water. With 3½ or 4 inch trough a 2 inch conductor pipe is used with a 5 inch trough, a 3 inch conductor and 4 inch conductor for a 6 inch trough. Different angles

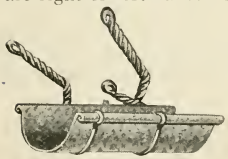


Fig. 126—Wire eave trough hangers.

Fig. 127—Conductor hooks.

Fig. 128—Eave trough corners.

Fig. 129—Galvanized corrugated conductor pipes.

shown are furnished to take care of any turn necessary in the conductor pipe as shown by Fig. 123. When ordering state which angle is desired.

When the conductor pipe is connected with cistern or reservoir it is advisable to place a cut-off near the top of foundation and make another connection with the sewer or drainage system. If the cistern starts to overflow the cut-off is fitted with a safety spring to conduct the water from one pipe to the other. If this cut-off is not used it is advisable to place a overflow connection in cistern.

Fig. 130—Drop outlets.

The troughs are fastened to eave of building by heavy wire hangers, as shown by Fig. 126. Be sure these are securely fastened and that trough has sufficient fall toward outlet. To fasten the conductor pipe to wall of building malleable iron hooks are used. Draw these up closely to conductor pipe so it will not rattle, but do not bend pipe. Complete estimate and lists of material will be furnished by our Hardware Department upon request.

Cisterns

CISTERNS are constructed out of wood, concrete or brick, for the purpose of collecting the rain or soft water for domestic uses. They should be located so that the water from the eave can be drained into them, and also easily accessible to supply laundry tub or plumbing fixtures. It is a good plan to supply them with overflow drains connected to the sewer, so as to take care of any oversupply of water in rainy seasons.

Wood cisterns are made square or round. When made square or box shaped they are usually constructed of a wood frame and lined with a galvanized metal or sheet lead. Round or barrel shaped ones are manufactured of cistern staves which have been creosoted to preserve the wood. Wood cisterns should be blocked up from floor so they will have ventilation on all sides, and will not become water soaked.

If cistern is constructed on outside of building, it should be covered over the top with 2 inch planks with the joints lapped with 1 inch material. This will prevent dirt from working its way into water. A man hole should be left at top and covered with a batten door.

Brick or concrete cisterns will cost considerably more than wooden ones, but will last a life time and are much easier to keep clean.

If cistern is built of brick, it should be lined with a plastering of good water-proof cement on the sides and bottom. Table XX will be found of service in estimating the number of bricks required for circular brick cistern, with open top. It also gives number of yards of excavation necessary, allowance having been made for sufficient room for men to work on outside of wall.

To find the capacity of a tank in W. S. gallons, multiply the length, by the square of the diameter and by 0.0034. For example: A tank 60 in. deep and a diameter of 96 inches:

The square 96 inches (the diam.) equals 9,216 inches.
9,216 inches by 60 inches (the depth) equals 552,960.
552,960x0.0034 equals 1,880 W. S. gallons.
(231 cu. in. to each gallon.)

TABLE XVIII

Capacity of Cistern and Tank

Number of Barrels (31⅓ gals.)

Depth in feet	Diameter in feet													
	5	6	7	8	9	10	11	12	13	14	15	16	17	18
5	23.3	33.6	45.7	59.7	75.5	93.2	112.8	134.3	157.6	182.8	209.8	238.7	269.5	302.1
6	28.	40.3	54.8	71.7	90.6	111.9	135.4	161.1	189.1	219.3	251.8	286.5	323.4	362.6
7	32.7	47.	64.	83.6	105.7	130.6	158.	188.	220.6	255.9	293.7	334.2	377.3	423.
8	37.3	53.7	73.1	95.5	120.9	149.2	180.5	214.8	252.1	292.4	335.7	382.	431.2	483.4
9	42.	60.4	82.2	107.4	136.	167.9	203.1	241.7	283.7	329.	377.7	429.7	485.1	543.8
10	46.7	67.1	91.4	119.4	151.1	186.5	225.7	268.6	315.2	365.5	419.6	477.4	539.	604.3
11	51.3	73.9	100.5	131.3	166.2	205.1	248.2	295.4	346.7	402.1	461.6	525.2	592.9	667.7
12	56.	80.6	109.7	143.2	181.3	223.8	270.8	322.3	378.2	438.6	503.5	572.9	646.8	725.1
13	60.7	87.3	118.8	155.2	196.4	242.4	293.4	349.1	409.7	475.2	545.5	620.7	700.7	785.5
14	65.3	93.4	127.9	167.1	211.5	261.1	315.9	376.	441.3	511.8	587.5	668.2	754.6	846.
15	70.	100.7	137.1	179.	226.6	289.8	338.5	402.8	472.8	548.3	629.4	716.2	808.5	906.4
16	74.7	107.4	146.2	191.	241.7	298.4	361.1	429.7	504.3	584.9	671.4	773.9	862.4	966.8
17	79.3	114.1	155.4	202.9	256.8	317.1	383.6	456.6	535.8	621.4	713.4	811.6	916.3	1027.2
18	84.	120.9	164.5	214.8	272.	335.7	406.2	483.4	567.3	658.	755.3	859.4	970.2	1087.7
19	88.7	127.6	173.6	226.8	287.	354.3	428.8	510.3	598.	694.5	797.3	907.1	1024.1	1148.1
20	93.3	134.3	182.8	238.7	302.1	373.	451.3	537.1	630.4	731.1	839.3	954.9	1078.	1208.5

TABLE XIX

Number of W. S. Gallons in Rectangle or Tank for 1 Foot in Depth.

1 cu. foot equals 7.4805 gals.

Width in ft.	Length of Tank in Feet										
	2	3	4	5	6	7	8	9	10	11	12
2.	29.92	44.88	59.84	74.81	89.77	104.73	119.69	134.65	149.61	164.57	179.53
2.5	37.40	56.10	74.80	93.51	112.21	130.91	149.61	168.31	187.01	205.71	224.41
3.	.....	67.32	89.77	112.21	134.65	157.09	179.53	202.97	224.41	246.86	269.30
3.5	.....	.....	104.73	130.91	157.09	183.27	209.45	235.63	261.82	288.	314.18
4.	.....	.....	119.69	149.61	179.53	209.45	239.37	269.30	299.22	329.14	359.06
4.5	.....	.....	.....	168.31	201.97	235.63	269.30	302.96	336.62	370.28	403.94
5.	.....	.....	.....	187.01	224.41	261.82	299.22	336.62	374.03	411.43	448.83
5.5	.....	.....	.....	.....	246.86	288.	329.14	370.28	411.43	452.57	493.71
6.	.....	.....	.....	.....	269.30	314.18	359.06	403.94	448.83	493.71	538.59
6.5	.....	.....	.....	.....	.....	340.36	388.98	437.60	486.23	534.85	583.47
7.	.....	.....	.....	.....	.....	366.54	418.91	471.27	523.64	575.	628.36
7.5	.....	.....	.....	.....	.....	.....	448.83	504.93	561.04	617.14	673.24
8.	.....	.....	.....	.....	.....	.....	478.75	538.59	598.44	658.28	718.12
8.5	.....	.....	.....	.....	.....	.....	.....	572.25	635.84	690.42	703.
9.	.....	.....	.....	.....	.....	.....	.....	605.92	673.25	740.56	807.89
9.5	.....	.....	.....	.....	.....	.....	.....	.....	710.65	781.71	852.77
10.	.....	.....	.....	.....	.....	.....	.....	.....	748.05	822.86	897.66
10.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	864.	942.56
11.	.....	.....	.....	.....	.....	.....	.....	.....	.....	905.14	987.43
11.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1032.30
12.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1077.20

TABLE XX

No. of Brick required for circular cisterns.

Inside diam. of cistern in ft.	Thickness of side walls in inches	No. of brick in side walls	No. of brick in bottom	Cu. ft. excavation
4	4	84	50	21
4	8	180	50	27
5	4	104	80	30
5	8	220	80	37
6	4	124	110	40
6	8	260	110	48
7	4	145	154	52
7	8	300	154	62
8	4	165	200	66
8	8	340	200	76
9	8	400	255	92
9	12	610	255	104
10	8	456	312	110
10	12	672	312	122
11	12	735	380	143
12	12	800	450	165
13	12	865	530	188
14	12	924	616	216
15	12	990	705	240
16	12	1050	800	270

Septic Sewage Disposal

THE general use in country homes of the modern conveniences of bath and toilet, has made necessary some effective and inexpensive means, in which to dispose of the sewage. Otherwise the drinking water will become polluted, and the health of the family endangered.

Entire satisfaction is obtained by the use of a septic tank, which is nothing but a long water tight cistern thru which the sewage passes very slowly and evenly. A septic tank consists of a water tight underground enclosure

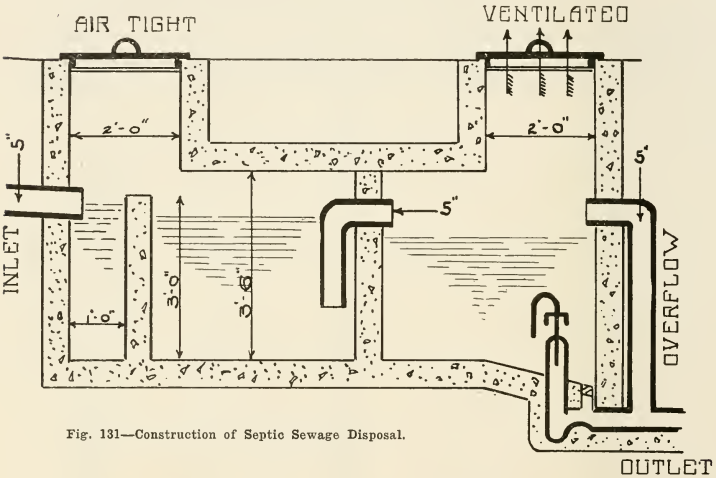


Fig. 131—Construction of Septic Sewage Disposal.

used for the storage and purification of sewage. The enclosure is usually constructed of concrete or brick, or may be made of large drain tile or barrels. Some are constructed with but one chamber or compartment and others have as many as four or five. The more compartments the tank has the purer the sewage disposed in the tile field.

By referring to Fig. 131 you will note that connections are made with the soil stack of the plumbing with sewer tile, which is laid out to the septic tank. The pitch of these tile should be from ¼ to ½ an inch per foot. Do not have too much pitch, for if you do the liquid will run away from the solid matter and the pipes will plug up. The connections into the septic tank should be made near the top of the first chamber. See Fig. 131. The joints of this connecting pipe into the septic tank, should be well cemented and swabbed out on the inside.

In the two chamber tanks which are ordinarily used for residences, the sewage enters the first chamber thru a curved pipe, which extends below the normal water level of this chamber. The first compartment is provided with a tight fitting cover, which keeps out the light, air and falling materials which

would otherwise disturb the scum that forms on the surface of the fluid in this chamber.

The first compartment is closed off from the second by a wall as shown in Fig. 131. Connections between the two chambers exist thru the bent pipe. The second chamber should be well ventilated. It also contains a connection which allows the discharge from the tank to pass out into the line of drain tile connecting with a running stream, or with the beds in which the last part of the purification process takes place.

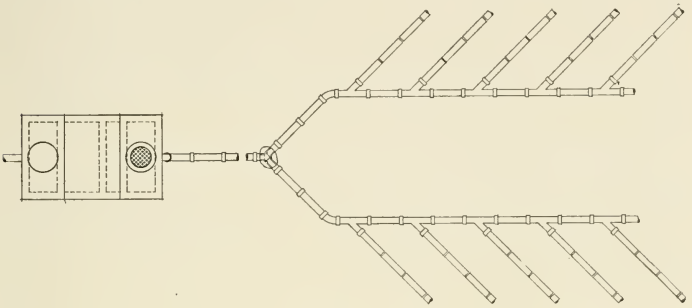


Fig. 132—Layout of tile field for septic sewage disposal.

The connection between the second compartment and the drain usually consists of an automatic siphon as shown in Fig. 131. This siphon works intermittently, depending on the depth of the liquid in the second compartment. The pressure on top of the ball of the siphon automatically regulates the periodic discharge of liquid into the drains leading to the beds for final disposal.

The action for the septic tank is based upon the fact that in nature, organic matter is broken down into inorganic compounds by certain types of bacteria. These bacteria are very small vegetable organisms which are widely distributed. They are so small that a single drop of water may contain thousands of them.

In starting a septic tank, the first sewage to come into the tank is seeded with bacteria from the air, water or soil. This army of little workers is divided into different classes, each class having its own special function. One class of bacteria is known as aerobic and lives only in the presence of free air and oxygen. Another class is called anaerobic, since it thrives only in the absence of air and oxygen. A third class is known as facultative, since bacteria of this class can live either in the presence of air or without it, as the case might be.

Each one of these classes has its own work to perform in the purification of sewage. The aerobic bacteria prepare the way for the anaerobic army by using the supply of oxygen which exists in the sewage as it comes into the tank. It is also bacteria of this class, which finishes the work of purification when the sewage has passed thru the tank and reached the beds where the effluent or discharge is finally deposited. The anaerobic bacteria, though com-

paratively few in number, are very active, and bring about the reduction or breaking up of solid matter which settles to the bottom of the tank.

From the above, it may be seen that the septic tank is a laboratory, in which a great number of busy little chemists are changing foul materials into comparatively clean and unobjectionable ones.

If we trace a quantity of sewage from the time it leaves a residence until it reaches its final destination, we shall find that it arrives in the tank in nearly the same condition as when it started from the house, except that possibly a small part of the oxygen has been removed by the aerobic bacteria in the drain pipe. When the sewage passes into the tank, the heavier parts sink to the bottom, while the lighter parts rise to the top of the first chamber of the tank, there forming a thick scum. This scum is the workshop of the aerobic bacteria, and also serves as a cover, shutting off lights and air and thus protecting the active anaerobic bacteria who are at work on the solid material in the interior and at the bottom of the tank.

The aerobic bacteria, at once set to work in the scum, and those parts of the sewage which are exposed to the air, or on new sewage containing oxygen, and by a putrefactive and fermentative process, change this part of the sewage to a liquid which contains no oxygen. After the incoming sewage is deprived of its oxygen, the anaerobic bacteria begins to work on the solid matter in the interior, and the bottom of the tank, and change it into material, which is again to be acted on by the aerobic bacteria at the surface, or at a later stage.

When a new change of sewage enters the tank, a part of that which has been acted on by the bacteria escapes to another chamber of the tank. The pipe or passage which takes this treated sewage from the first tank to the second, is so arranged that the quantity of sewage passes from the first tank, and is taken from that part of the tank, midway between the scum at the top and the sediment at the bottom.

The partially purified sewage in the second chamber, is removed at intervals by means of a hand-operated plug, or an automatic siphon, connected to the drain pipe used to conduct the liquid away from the tank. The final step in the process of purification is completed by allowing the liquid which is without oxygen to flow out into the porous, air-filled bed of material to become thoroughly charged again with oxygen and acted upon once more by the aerobic bacteria in this bed. The result of this last action is the changing of the effluent into clear, practically pure and harmless liquid, and can be discharged into ordinary farm drain tile.

Although the odor from a small septic tank is practically unnoticeable, yet it is best to locate it at least one hundred and fifty feet from the house. Choose a spot where it can be sunk to ground level and will be out of danger of flood waters.

The tank should be large enough to hold the entire sewage for one day. For a family of eight or ten, plan a two compartment tank, each compartment 4x4x5 feet long. The top and bottom are 4 in. thick, the division and side walls from 6 to 8 inches; dig the pit 4 ft. 8 in. deep, 5 ft. 4 in. wide and about 12 ft. 0 in. long.

If the ground stands firm, only one inside form will be needed. Make two, each 4x4x5 ft. long. Old 1 in. lumber will do for the form. Cut the proper openings for your connecting tile, man holes, siphon and overflow outlets.

Mix the concrete 1 part Portland cement to two parts sand and four parts crushed stone, or one part cement to four parts pit gravel. Mix to a quaky mixture and put in forms.

The man-hole at the top can be made for wood, iron or cement cover. A good cover can be made for the man-holes at the top, by having your tinner make two round bottomless dish pans 18 in. at the bottom and 24 in. at top. Grease these tin molds and set them on the form over each compartment. Then make two concrete forms to fit into these. The first cover should be air tight and the second one ventilated.

It is a good plan to use some heavy woven wire fencing or 3/8 in. iron rods to strengthen the concrete on the top of the tank.

It is often considered a good plan to have two gates from the diverting chamber, so that they can be used alternately and thus allowing one field to dry out while the other one is in use. The tile field is the final place or the completion of the bacterial action. These tile fields should be located as far away from your well or water supply as possible to prevent any possible chance of pollution of the water. The joints should be covered with coarse gravel or crushed stone to allow the liquid to gain access to the ground. Figure 132 shows arrangement of tile field.

Wiring and Lighting

General Conditions and Notes

ELECTRICITY has become one of the most valuable aids to modern housekeeping. Safety, convenience, cleanliness, efficiency and economy —these are its advantages, which ought to be enough to convince the most skeptical of house builders, that his new home should be wired.

As the work of an electrician is invariably inspected by a public building inspector, and must be done to comply with the building codes of the city, in order to receive a service permit, the builder will most always receive a satisfactory job along this line, but there are many things which we know will be of help to our customers, even though they do not plan on putting in their own wiring system.

It is the best plan to first have a lay-out, or plan of the wiring which will show the location of switch, light service, entrance switch box and meter. We have shown on drawings, a lay-out which is merely suggesting the different locations, but as we do not know how many, and the kind of fixtures to be used, we cannot do this with any degree of accuracy.

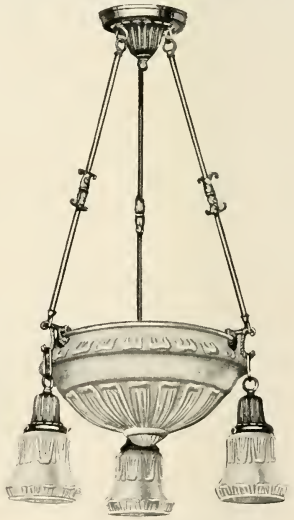


Fig. 133—Suitable central illuminating fixture for large living room.

It is always considered a good plan to keep the baseboard receptacles on separate circuits. This arrangement will give every room two circuits, so that in the event of an interruption on one circuit, the room will not be left entirely without service, and a fuse being blown by a faulty development in a worn flexible cord will not interrupt the lighting of any regular ceiling outlet. This gives a somewhat larger number of circuits than is absolutely necessary, and takes a few feet more wire, but it has the advantage of allowing a liberal capacity on every circuit so that if any unexpected large load is taken from any outlet, that circuit is not likely to be dangerously overloaded.

The location of the lamps, will in a measure, depend upon whether they are to give a general illumination, or whether the light is to be directed to certain areas, such as reading table, side light for dressing table, etc. In locating lights, take into consideration the location of different pieces of furniture in the room, shadows, etc. Nothing looks quite so unsightly as to have to run an extension in order to get light to proper place in room. In locating lamps and outlets, remember that each additional lamp or switch means, additional cost in wiring. Arrange your lights so they will illuminate as much of the house as possible and give a good appearance. Do not have any dead outlets in your home.

The living room should be the one given the most consideration, as this is probably the room used the most. A large ceiling fixture which contains four or five lights is generally placed in the center of the room. The size of the fixture and the light, of course, will be governed by the size of the room. Do not get them out of proportion. In addition to this fixture, are sometimes installed at least two wall brackets. These are placed alongside of fireplace if the room contains one. It is also advisable to place at least one auxiliary outlet to use for reading lamp.

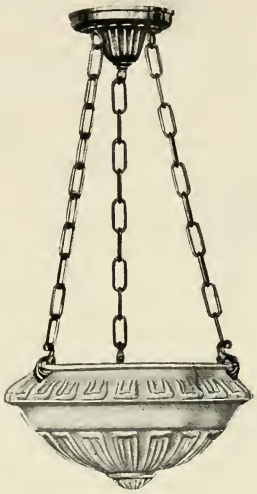


Fig. 134—Indirect lighting dining room fixture.

The dining room is most satisfactorily illuminated with a central cluster, or semi-indirect dome, placed over the dining room table and, if the room is large enough, wall brackets with pull sockets can be used on each side of china closet or buffet, with good effect. The central fixture should be controlled with a push button switch, which you want placed so that it will be handy in leaving and entering the room.

If the kitchen is small, one ceiling fixture placed in the center of the room, should be sufficient if a high wattage lamp and reflector are used. If, however, the kitchen is large, a wall bracket should be placed over the range and sink, these wall brackets to be controlled by pull sockets, and center fixture by push button switch. Always provide the kitchen with at least two outlets, to be used for electrical toasters, iron, or any of the useful electrical improvements now commonly in use.

Fig. 135—Hall and central bed room fixture.

The illumination in the sleeping rooms is quite a problem, as it is sometimes impossible to decide where the different pieces of furniture are to be placed. Generally, the plan should indicate a central ceiling fixture, and one or two wall brackets, placed so they can be used at sides of dressing table or dresser, to properly illuminate the mirror. A wall bracket placed at the head of bed is also very handy for reading purposes.

Bathroom should be fitted in about the same manner as bedroom, that is, with central fixture and wall brackets, the brackets to have pull sockets, and central fixtures push button switch, brackets to be located above lavatory.

The halls should be provided with general illumination with central fixture, controlled by push button switch located to be accessible on entering house. Upper halls are to be fitted with two-way switch so that it can be controlled from down and upstairs.

The porch light should be controlled from lower hall

near front door. Porch outfits, consist of central fixture and two brackets, one on each side of front door being very appropriate.

The cellar should be wired for sufficient light to illuminate all dark corners. Outlets placed at foot of cellar stairs and in front of furnace will be appreciated. Switches for central light should be located at head of cellar stairs, so that it can be operated on leaving and entering.

In addition to the fixtures for general illumination, it is a good plan to have a small light in each closet. The additional expense for the outlets is very small, the current consumption will be negligible and an added convenience, especially in closets where clothing or supplies are placed on shelves. A good lighting is necessary to maintain a proper tidiness.

Fig. 136—Kitchen fixture.

After the outlets have been located on plan, we pass to the location of the switches, cut-out boxes, service switches and meters.

The switches want to be located where they will be the most convenient is using on entering and leaving room. Do not place a switch behind a door; place it near the door but on the opposite side from which the door is hung.

The arrangement of switches in the main halls, should appear to be especially convenient without over elaboration. Three-way switch should be installed, to control the lights from lower main hall, to upstairs hall or entry. The upper hall should be equipped in the same manner to use on returning. The rear entrance light, should be operated from the same switch, as the basement hall, it being considered that the former will rarely be needed except when going down cellar, and also that it will serve as a pilot, to show when the basement light has been left burning.

In some cases the service should be made heavy enough to stand the addition of an electric range. On the back veranda, kitchen and laundry where ironing is most likely to be done, outlets should be placed high (about 6 ft. from floor) so that the ironing cord will not interfere with the work. The outlets will be equally valuable for any other work.

A liberal number of baseboard receptacles should be installed at convenient places. These will carry lamps, toasters, water heaters, vacuum cleaners and above all, small electric heaters for Spring and Autumn use before the furnace is operating.

Fig. 137—Porch lantern.

The cut-out boxes should be made fire-proof, provided with doors and fastenings, and then cut-out and service switches located in the circuit as near where the wire enters building as possible. The service cut-out and switch, should be arranged to cut off all current entering building.

Fig. 138—Bath room and bed room wall bracket.

On small voltage lines, approved indicating snap switches are advised in preference to knife switches. The meter should be situated in the circuit just inside the service switch.

The wiring should all be "roughed in" before the lathing of the building

is started, or plaster board applied, so that the work can be concealed as much as possible. The wiring must be installed in accordance with the latest rules and requirements of the National Board of Fire Underwriters, and approved by the local building inspector.

The size of wire to be used, will be governed by the number of lights and the amount of current to be furnished. No. 12 or 14 B. & S. gauge is generally heavy enough for ordinary dwelling houses.

The cost of installing is generally based, on the number of outlets and switches (not lamps). On new work where it is easy to run lines, it will cost about $1.25 to $1.50 per outlet, which will include switch cleats and all roughing in material.

The builder should see that wood blocks are nailed in place around the outlet of switches and fixtures, to fasten switch plates and fixtures to. No wiring of any kind should touch any wooden portion of the building. Carry wiring on porcelain cleat or thru conduit. Have wire drawn up tight between cleats; do not allow it to sag. All joints should be well soldered and insulated.

A means of protecting the wires that is being recommended by many underwriters, is to place them in conduit, which is nothing more than a strong, smooth, water tight tube having its inner surface coated with an insulating compound; or second, to use what is known as flexible armored cable. There, pipes are installed and fastened in place by means of a strap.

Fig. 139. Boudoir lamp.

The chandelier, fixtures, switches, etc., should not be put in place until the interior of the building has been completed. This will prevent them from becoming spotted by paint, varnish, etc.

Standard Wiring Symbols
Ceiling Outlet Electric only. If Gas
Ceiling Outlet, Combination.
Bracket Outlet, Electric only. If Gas
Bracket Outlet, Combination.
Wall or Baseboard Receptacle Outlet.
Floor Outlet.
Outlet for Outdoor Standard, Electric only
Outlet for Outdoor Standard Combination.
Drop Cord Outlet
One Light Outlet, for Lamp Receptacle.
Arc Lamp Outlet.
Special Outlet, as described in Specifications.
Ceiling Fan Outlet.
S^1 Single Pole Switch Outlet
S^2 Double Pole Switch Outlet
S^3 3-Way Switch Outlet
S^4 4-Way Switch Outlet
S^D Automatic Door Switch Outlet
S^E Electrolier Switch Outlet
Meter Outlet.
Distribution Panel.
Junction or Pull Box.
Motor Outlet. Numeral indicates Horse Power.
Motor Control Outlet.
Transformer.
—— Main or Feeder run under Floor.
——— Main or Feeder run under Floor above.
----- Main or Feeder run exposed.
Numerals indicate number of 16 candle power Electric or Gas Lights.

Typical Specifications

These specifications are intended to cover the supply of all necessary material and labor for the installation of a complete wiring system for lighting, etc., in the new residence of

---

Working Conditions:

House is located at ------

House is framed and roofed, but not finished.

Electrical work may be started immediately.

House is frame construction.

Plans

Plan No. — shows the "Wiring plan" of residence and shall be considered as forming an integral part of these specifications.

Circuits, outlets, etc., are indicated by the "Standard Wiring Symbols" illustrated here.

Detail Specifications

(1.) Install standard service pipe in rear of house as shown, same to consist of three No. 8 wires and 1 inch conduit.

(2.) Install meter board 3 ft. wide by 2 ft. high covered with a clear sheet of ¼ inch asbestos painted black.

(3.) On meter board install 3 p. s. t. 250 volt, 60 amp. knife switch and five three to two wires double brand fuse blocks with fuses and make all necessary connections ready for meter.

(4.) Install 10 branch circuits thruout the house as shown on the plan and detailed in the summary.

Nature of Work

(1.) All work shall be standard "knob and tube" construction, in all respects of the most up-to-date practice and best workmanship.

(2.) All wires brought down walls of basement to switch, etc., must be run in metal moulding.

Location of Outlets

(1.) Ceiling outlets must be accurately located so as to bear proper relation to the decorative detail.

(2.) Bracket outlets in all closets to be located immediately above the center of the doorways. (To equip these with pull receptacles.)

(3.) Other bracket outlets in pantry and top landing to be located 5 ft. 6 in. above floor.

(4.) Baseboard receptacles to be mounted 6 inches above floor, except in kitchen and back veranda, which are to be 6 ft. above floor.

(5.) All switch outlets to be mounted 4 ft. above floor unless special wall details require other wiring.

(6.) In any case where the directions of door swing is reversed from that shown on plan, the switch must be changed to the opposite side correspondingly.

(7.) Switch outlets located on any panel wall must be carefully centered.

Control

(1.) All switches indicated on the plan will be of a standard single-pole type controlling one outlet only, with the following exceptions:

(2.) Both laundry outlets can be controlled on the same switch at entrance to laundry.

(3.) Rear entrance and basement hall to be controlled together by the same switch at first floor entrance to cellar.

(4.) Main hall to be controlled by a pair of 3-way switches in the lower and upper halls and also with a single button switch to be located convenient to stairs.

(5.) All wall brackets and base plugs should be direct in and not controlled by switch to main fixtures.

Fittings

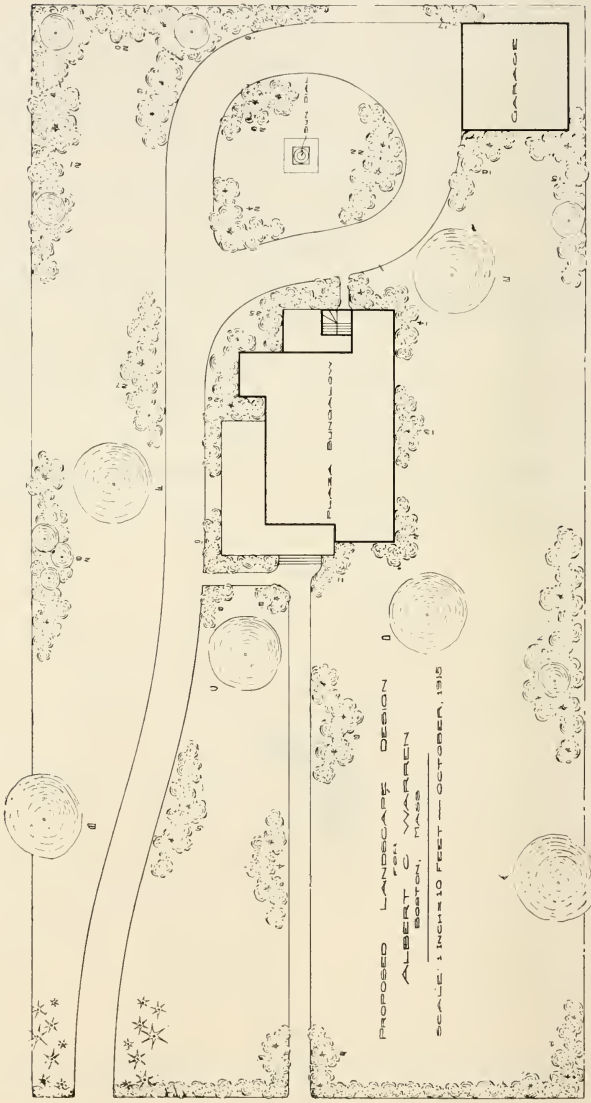
(1.) All switches in the main rooms of the building should be of push button type of best quality.

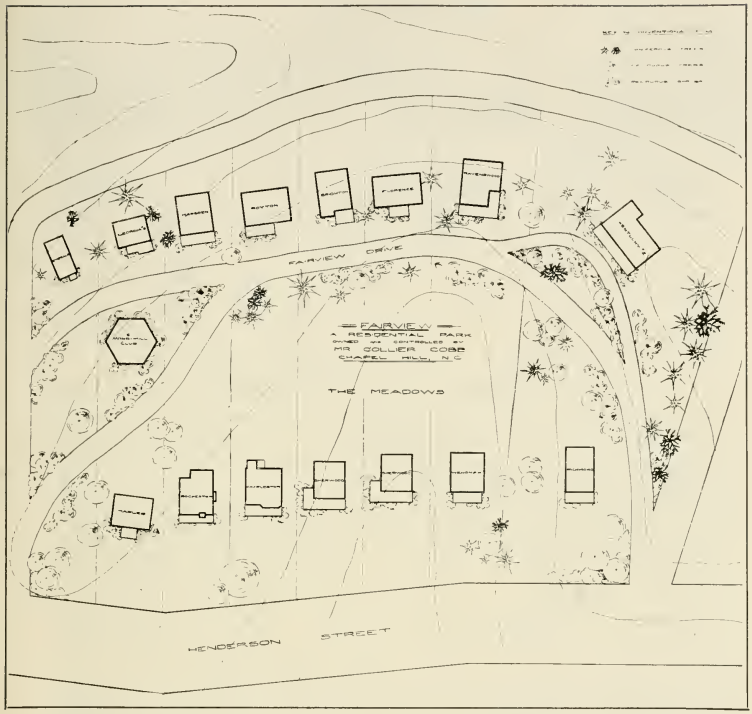
(2.) Basement and closets can be of the rotary snap switch of approved type.

(3.) All switch plates should be the same finish as the other hardware of the room.

(4.) Finish of face plate of plug receptacle to be same as other hardware.

The above specifications can be altered to meet your requirements.


PROPOSED LANDSCAPE DESIGN
FOR
ALBERT C WARREN
BOSTON, MASS
SCALE: 1 INCH = 10 FEET — OCTOBER, 1915
GARAGE



Part II

Our Landscape Department of Service

"THE first sure symptom of a mind in health, is rest of heart, and pleasure felt at home." Did you ever consider the vast difference in the meaning of the words house and home? A house is a structure to live in, a home is the dearest place on earth; it is a part of yourself and expresses your taste and character.

Aladdin's interest does not stop when the order has been received—but

ever bearing in mind the many nice discriminations to be made in the locating, adorning, and surrounding of the home, the Department of Service was early established—to advise, direct or take full charge, as the home builders may desire, of this part of home making. As we have so often said, it is the use of such skill that changes a place to stay—a house, to the dearest place on earth, a HOME.

Perhaps you find it difficult to express your tastes, as you feel them, when it comes to the arrangement, furnishing, and decoration of your home. You may not be sure of yourself. Right there is where our Department of Service can help.

This department is in the hands of people trained in the planning and arrangement of artistic exterior and interior effects for the home—design, decoration, landscaping, etc. It is organized and maintained for a single purpose—to serve our customers. There is no charge for this service.

If you have a general idea of color in the exterior painting plan that you would like to follow, let the service department work out the details. In the interior finish and wall colors you may either put the responsibility entirely up to the department, or by suggesting general preferences, it will work to your suggestions and carry out the details.

By furnishing the department with the size of your grounds, sketches will be worked out for attractive planting of shrubberies, plants, trees, etc., with lists of seeds and vines.

In fact, the Department of Service will help to make your Aladdin house, home, in every sense possible.

In seeking this service you have only to address the Department of Service, care of this company. The service this company renders its customers in decoration and planting would cost Fifty Dollars to Five Hundred Dollars if you consulted the average landscape architect. It is but one of the links in the chain that forms such a close bond between our customers and us.

Helpful Hints in Gardening

Introduction

IT is the intention of the author to make this part of the Aladdin Manual as complete as possible, giving practical information dealing with the home maker and amateur gardener. Careful study and planning before beginning will have much to do with results accomplished along this line—developing the exterior of the home.

The beginning of a garden is about the most important part of it, for unless the beginning is good, all that follows will fall short of the excellence which should be obtained. Well begun, a truly beautiful garden is possible almost anywhere, even within a decidedly limited space.

The real beginning of a garden, especially on a small place, lies away back of the time when the initial steps toward making it are taken, however, this is the stumbling block lying in the way of everyone who has not given the subject of his garden making more than an average thought. The design, size and beauty of all small gardens depend almost entirely upon the position and plan of the home in which they are a part, hence such a garden's beginning in the truest sense is contemporary with the planning and locating of the house.

The term "garden" does not mean an acre lot full of vegetables, nor even an open space full of flowers, but rather that part of the grounds adjacent to the house which is treated in a manner to display it to its best advantage. The garden is that part of a home which gives it a true artistic appearance and is, therefore, a characteristic partly natural and partly conventional. Some attempt at an attractive treatment at the grounds is almost always made by the home builder and the tendency today is to discuss the placing of shrubs, flowers and paths so as to best display the good qualities of the building and to mask as far as possible, its weak points.

No house, however small, should be left without some serious effort at arranging the surroundings to harmonize with the house. These may be of the smallest description, a few shrubs, vines against the house and some small trees, or, as is the case with some of our large country houses, the surroundings

may be treated for miles to lead up to the heart of the whole, the house of the owner.

The exterior of your house is far more important than the interior. It is seen first and last and by more people. Whether large or small, old or new, the attractive yard takes the leading part of a charming home.

One of the most important features of a city home or country estate is a well kept lawn. You may have flowers in profusion, and great forest trees in just the right location, but the thing which really adds to the beauty of the home is a smooth, velvety lawn.

It would be impossible to give detail information regarding the preparation of the soil and planting of trees, flowers, shrubs and other garden plants suitable to all our varied climates. nor will one planting scheme be suitable for all our different houses, but suggestions will be made as to exterior decorations which we hope will be helpful to the builders of our ALADDIN homes.

Lawns

No matter how much care is exercised in the selection and planting of flowers, shrubs, etc., the beauty of the garden depends mostly on the lawn. Who has not been captivated by the lengthening shadows over an unbroken area of closely cut grass in the late afternoon of a bright summer day? The glory of the magnificent parkways and boulevards are great lawns stretching away into mazes of shrubbery and woodlawn.

What might be termed a corollary to a good lawn are perfectly kept sidewalks and drives. The beauty of each is enhanced by the perfect condition of the other. Walks should be properly drained and accurately edged and above all things, rolled frequently to make them hard and pleasant to walk on.

To the thousands of anxious inquiries seeking solutions of lawn difficulties, it would be more than delightful to say that a fine lawn could be had by very hard wishing, but honesty compels one to change "hard wishing" to "hard work." A well made lawn is a very good testimonial to a hustler and one who takes pride and comfort in his home.

The majority of inquiries about lawn needs, come from people having some place from a few hundred to a thousand feet, and the symptoms described can be divided in two classes: one where it has never grown before, and the other where the call is for information to assist in restoring old lawns that have petered out. The first condition is the only one that will be of value to new Aladdin builders, but we will also discuss the second for future reference.

Restoring Old Lawns

Where grass has grown for some years. it is conclusive evidence that there must be soil beneath, which, perhaps because of neglect, has ceased to supply the nourishment necessary to maintain the vigor of the sod grown upon it. As a consequence, weeds gradually creep up and finally crowd out every blade of grass. A condition like this is easily remedied and an improvement brought about in a short order at a very small expense. In the first place, make a general cleaning up of the weeds and do it as thoroughly as possible. Take them out with a strong knife, cutting deep into the ground. An asparagus knife is the best for this purpose.

If the places under treatment were to be spaded up, this weed cleaning with the knife would not be necessary but the object in this instance is to disturb the soil as little as possible.

With the weeds out of the way, go over the whole place with a sharp rake and scratch the earth to the depth of half an inch. In doing this, remember not to be too severe on spots where there is any grass growing, applying the rake lightly here. After the raking, sow grass thickly and evenly, raking it in, and finish it by raking, watering and rolling. Be sure to roll heavily, water regularly, and good results will surely come.

If, however, you should find that the ground shows patches of moss and sorrel, the treatment just suggested will not apply. The land is probably sour, and should be plowed up, limed and allowed to lay rough all winter. Use about 1½ bushels of air slacked lime to a thousand square feet.

On small places where the necessity for radical treatment is apparent, yet where it is not advisable to upset the premises at that particular time, results can be reached in a way that will be effective.

Take a round stick about one inch in diameter and sharpen one end to point. At frequent intervals about the grounds drive the stick to a depth of about 18 inches and into these holes ram a mixture of finely powdered manure, hardwood ashes and bone meal. Cover the holes with leaves. In a short time the good effects will be noticeable and during other seasons the same treatment can be extended to the parts not touched before.

What is the secret of having a good lawn? If we are about to make a new lawn, much care must be given to the proper preparation of the soil. The ground should be plowed and thoroughly worked from ten to twenty-four inches deep so that the grass roots will have ample opportunity to take deep hold and not dry out in the baking hot days of midsummer. Start the preparation for a new lawn in the fall, during the winter the frost and snow will greatly improve conditions, killing the weeds and mellowing the soil, as nothing else can.

A liberal application of good manure should be incorporated in the soil, as it supplies moisture-retaining properties which are invaluable. Before sowing the seed, which should be a mixture of the finer grass seed and clover, a liberal application of bone meal and wood ashes should be raked into the surface thoroughly. Then on a calm day, sow the seed thickly and after raking it in, roll well several times with a good hand roller until the surface is perfectly firm and smooth.

Lawns made in this manner are ready for use almost as soon as a lawn made from sod, and the results from seed are infinitely superior.

For a new lawn, use one quart of seed to three hundred square feet.

No lawn can reach perfection on sour, wet soil. If these conditions exist, the ground must be drained with tile before there can be hope of success. Plow it, lime it and allow it to lie rough all winter.

After all heavy rains, especially during the hot summer months, a careful rolling is of the greatest benefit to a lawn. It not only makes the surface even and so perfects the work of the mowing machine but also firms the ground and discourages the ravages and insects. Rolling also saves much wear and

tear on the mowing machine that comes from shoving it over hard, lumpy ground.

Draining Land

Where the soil is soggy and retains too much moisture, this condition must be remedied before making it into a lawn. The remedy is found by drainage and this can be done by digging ditches or laying tile underground at various distances apart and all receding toward the lowest part of the land, to which the water will have a tendency to flow.

Grass Seed

While many people can talk freely on the preparation of the land for lawns, they are not so confident on the treating of grass seed. It seems strange that this is the case when so much depends on the suitability if the grass seed to the land for the making of a successful lawn. There is, however, just as much individuality in a plant produced from a grass seed as in the choicest plant in a green house. One kind of grass seed will produce a low growing plant, while another grows high; one wants a moist location, and another thrives in a dry place, some will germinate in the shade, others will not. If a person knows each kind and its requirements, he will be able to choose the grass best suited for his soil and location. If you are spending considerable time grading and preparing your lawn it would be advisable to secure a sample of each kind and make a number of small patches in different places on your plot. Then use the one which shows the best results under all conditions.

Kentucky Blue-grass (Poa Pratensis)—Fine for lawns; grows slowly, but vigorously almost everywhere but in an acid soil.

Red Top (Agrostis Vulgaris)—Shows results more quickly than Blue-grass; will thrive on sandy soil; fine when mixed with Blue-grass.

English Rye Grass (Lolium perrum)—Grows quickly and shows almost immediate results; good in combination with slow growing Blue-grass.

Various leaved Fescue (Festuca heterophylla)—Good for shady and moist places.

Rhode Island Bent (Agrostis Canina)—Has a creeping habit; good for putting-greens, sandy soils.

Creeping Bent (Agrostis Stolonifera)—Creeping habit good for sandy places and to bind banks or sloping places. Combine with Rhode Island Bent for putting-greens.

Crested Dog's-tail (Cynosurus Cristatus)—Forms a low and compact sward; good for slopes and shady places.

Wood Meadow Grass (Poa Nemoralis)—Good for shady places; is very hardy.

Red Fescue (Festuca Rubra)—Thrives on poor soils and gravelly banks.

White Clover (Trifolium repens)—Good for slopes; not to be recommended for a lawn.

Sheep Fescue (Festuca Ovina)—Good for light, dry soils.

Now with the above information you will have sufficient knowledge as to the kind of seed to draw from to make combination to fit any situation.

When you get your sample from your dealer, make a careful comparative examination of the seeds, holding a little in the palm of the hand. As you look at each kind of seed, repeat its name a few times and study its characteristics and you will be surprised to find on the second or third trial every name will suggest itself the moment your eyes rest on the seeds. You will then be a better judge of what kind of seed you want than your dealer.

If you should go to a dozen people and ask them to suggest a combination of seeds, they would all give them to you, but no two proportions would be alike. If you should ask for a single grass the majority would suggest Kentucky Blue-grass. For a single grass there is nothing better suited for all conditions. There is one objection to it, however. You cannot plant it today and have a lawn next month. If you can afford to wait, sow Kentucky Blue-grass and your patience will be well rewarded. It makes a permanent lawn.

To introduce a ready-made lawn, use a combination of Kentucky Blue, Red Top, and English Rye. The Blue-grass is slow, but the Rye and Red Top produce speedy results. The first month will see the newly seeded space a carpet of green. In time the Rye passes, the Red Top continues to cover, while the Blue-grass grows sturdier each day until it crowds everything out by virtue of its own strength. Use twelve pounds of Kentucky Blue-grass, five pounds of Red Top, and three pounds of English Rye to the bushel, and sow 3½ to 4 bushels to an acre. This makes a reliable combination. It is common to hear people ask for grass seed that will grow in shady places, but it is always difficult for the dealer to determine the degree of shade. A place may be shaded, but yet suitable for growing grass and it may be shaded so that no seed known would grow there.

In places where there is no heavy dripping and where the ground is not absolutely dark, use the following:

Kentucky Blue-grass, Wood Meadow, Various-leaved Fescue and Crested Dog's-tail. Use about 35 per cent. of the first two and 15 per cent. each of the last two.

For conditions that require a quick growing grass and something that will bind and make a holding upon slopes under difficult conditions, the following is recommended:

Kentucky Blue-grass, 30 per cent.; Rhode Island Bent, 30 per cent.; Creeping Bent, 25 per cent.; Sheep Fescue, 10 per cent., and White Clover, 5 per cent. This is one place when White Clover is essential. Under this condition it fulfills its duty perfectly. While all other kinds named may not flourish, there will be enough of each to make the combination successful.

Never buy grass seed by the bushel. Buy it by weight, or state that there should be so many pounds to a bushel. It may cost you a high price, but it will be far cheaper in the end than to buy something inexpensive that will have a lot of sweepings and useless bulk. Use the very best seed you can obtain.

Do not be ashamed to get samples from different concerns before buying, and compare the different seeds. Spread them out in your hand and see if they are clean and without chaff. A seed with a large proportion of dust and chaff is not worth buying. Do not balk at the price charged for recleaned seed. It means that you are going to get something for your money. It is worth much more than the seed sold in bulk that is not recleaned.

Sowing the Seed

Grass is nothing but a collection of thousands of little plants crowded together, which must have nourishment and from which the weeds must be taken. Likewise the soil must be given water as it is needed, and the earth must be made mellow for the roots, to a good depth. It makes no difference how much you pay for your grass seed, how good or how bad it is, or what kind of fertilizer you use, if the bed is not properly prepared in the first place. Without this fundamental preparation, grass plants will not grow or if they do, will not thrive.

It is quite a trick to sow grass seed evenly so that it will germinate without giving the plot a spotty effect. It should be spread at the rate of about three bushels to an acre, and this sowing can be successfully done only on a quiet day. Even a very light wind is liable to pile up your seed on your neighbor's lot as on your own in places not wanted. Keep the seed in a pail while sowing, and after taking a handful, bend close to the soil and let the seed feed thru the fingers as the arm swings back and forth in a semi-circle. This is very much easier to say than to do, but a little experience will make one quite proficient. To help still more, sow the seed two ways, at right angles to each other. After sowing rake lightly and then finish by putting a heavy roller over it.

While thick sowing has the advantage of discouraging a growth of weeds, there is a limit that cannot be safely passed. Seed sown too thickly will mat and damp out, leaving great bare patches on the lawn.

Spring sowing should be done just as soon as the frost is out of the ground. This early sowing gives the young grass a chance to establish itself before the severe summer heat comes on. Careful watering is necessary, with a fine spray, and if regularly done will induce rapid germination. In watering, do not wash out the seed by too heavy a stream.

Good Loam and Fertilizer

Good loam is scarce. In the fall when the leaves are falling from the trees, it is a good plan to gather them up from the gutter and put them in a pile. These will decompose in time to a much desired humus. This might be a little trouble, but you will feel fully repaid for the time, when you will want some good loam. In some cities loam of very inferior quality will cost about two dollars per cubic yard and if one has a quantity of this leaf mold, made as suggested, and will mix it with the loam, a very desirable quality can be produced. The leaf mold is the life of the soil and absolutely essential to satisfactory results.

When a top dressing is necessary on soil that is good, Canada hardwood ashes and bone meal will supply all the nourishment necessary. Spread the ashes thickly on the lawn until they show white on the grass and do this preferably before a rain, so the nourishment may be washed into the soil. The hardwood ashes should contain from 7 to 9 per cent. of potash. When it is impossible to get a good grade of hardwood ashes, mix muriate of potash with a finely sifted loam, and spread it over the lawn.

Nitrate of soda is a very vigorous stimulant and produces quick results. It is economical, requiring but small quantity to cover large areas. Spread

about 175 pounds to an acre; or if dissolved three pounds to 100 gallons of water. The dry applications should always be made before a rain, otherwise much burning is apt to result to the grass.

Lawn Mower, Roller and Hose

Young grass should not be cut before it is three inches high and this means that a scythe should be used in preference to a lawn mower, as it is difficult to get the blade high enough to allow this length. In cutting for the first time try to do it on a cloudy day, as this will prevent any possibility of scorching or burning. After a few weeks the grass will become toughened and will be beautified by frequent cutting about every 5 or 6 days.

The roller should be used after every cutting if possible and although it may, seemingly, be working injury by crushing down the tender grass, it is really making sure a solid and compact sod. In the middle of the summer when the sun is very hot the grass should not be cut close, as the roots are liable to be killed by the sun.

When cutting your grass you will find it a great saving to have some sort of a grass catcher on your lawn mower. One can be made easily, but a very handy one can be purchased for about fifty cents. They prevent the wear and tear on the lawn by hard raking. If you prefer to rake use a wooden one, as iron teeth damage heavy sod. Where the grass is cut often the clippings may be left on the ground, but heavy cuttings should always be gathered up.

Once or twice during the season give your lawn mower a good over-hauling. Grass and grit will work its way inside and if not removed will reduce the efficiency of the machine. Oil well with a good grade of oil.

Although this part of making a lawn is often sadly neglected, it is a very important one. In using the roller, use a heavy one on your lawn early in the spring to repair the damage done by freezing and thawing. The early rolling levels the surface, packs the earth around the grass roots and makes it possible for them to draw the moisture from deep down in the ground. The consistent use of a roller will mean that you will have fewer weeds, thicker and better colored grass; the disfiguring moles will find the ground too difficult to burrow thru, moisture will be retained longer and a noticeable better condition will be seen thruout the whole lawn.

The hose is a subject to which considerable attention should be given. A first quality hose will cost from twenty to thirty cents a foot and should last for years when properly cared for. When a hose bursts, it is best repaired by cutting entirely thru it and removing the damaged part and then joining the ends with a little brass sleeve that is easily inserted into each of the severed ends, and which has reverse prongs to prevent its slipping out. Keep your hose on a reel. Empty it of water before winding up and never allow it to lay baking in the sun. The latter is a common fault and is the cause of much good hose being spoiled. Another seemingly small, yet important thing, is to caution against so fastening the hose to the tap that it pulls away from it at right angles.

Weeds and Worms

Even when you purchase the very best grass seed and take care of your lawn, you are bound to have more or less weeds. The thing to do when you

have them is to get rid of them. The knife is the only real weapon for this purpose. After digging out your weeds, sow in grass seed with the idea of making the grass grow so thick that there will be no place for the weed to creep in. On newly made lawns the weeds are easily removed and they should be carefully watched so as not to allow them to get too far ahead.

Very often earth worms become very disfiguring on a grass plot. Where there are many present it is an indication that the earth is in poor condition, compacted and needing humus. An application of strong lime water will drive many to the surface, where they can be swept up; or a heavy rolling will do much to discourage them.

It is surprising how much damage a colony of ants can do on a lawn. They should be looked after the first time they are noticed, for they work rapidly and the longer neglected the more difficult it is to get rid of them. There are many remedies but the best one lies in the use of bisulphide of carbon. This is very effective, but it has come into such common use, that a word of caution should be given as to its handling. It is very explosive when near flame, due to the gas it contains. Pour it into the run ways or hills of the ants, and then cover with a mat. The fumes will soon kill all the ants. Another way is to drive sticks into the ground and fill holes with the carbon and then plug up the holes tightly.

Trees

IT is best to select trees and shrubbery that are known to endure naturally the conditions of soil and drainage that one has to offer them, rather than attempt any expensive preparation for plants not fitted by nature to such conditions. Generally speaking, trees and shrubbery will thrive in any soil that will grow good vegetables.

Recently graded areas are apt to be void of fertile humus, bearing "top soil," and when such soil is provided, trees and shrubbery cannot be expected to have a vigorous, healthy growth in it.

No difficulty will be experienced in transplanting trees if the following directions are followed. The most inexperienced men can set out orchards or trees of any kind with the highest degree of success. A large per cent. of the trees that die when planted, do so because the persons who planted them did not have directions for transplanting to follow, or did not follow the ones they had. These directions are invaluable to you, for if you follow them your trees, plants, etc., can be set out with the surety of a reasonable degree of success.

The proper preparation of the soil is necessary to successful planting. Very few trees or plants will do well on ground that is naturally wet or cold, without artificial draining.

If the soil is rich, it will not require any fertilizing, but if it is poor, add manure or artificial fertilizer. For town lots, where there is much clay or sod, dig holes much larger than the roots would require and use good black dirt for planting. This will give the trees good soil to start in. Do not allow sod to grow around the trees nearer than three feet for two or three years at least, as this will prevent the water from working its way down to the roots of the trees.

How and When to Plant

Fall planting is advisable where winters are not extremely severe. By planting in the fall, the tree establishes itself and is ready to start growth early in the spring, thus acquiring strength to withstand summer droughts.

As soon as the trees are received from the nursery they should be unpacked, shaking out all packing, and if possible, planted at once. However, if they arrive during frosty weather, place them unpacked in a cool, dry cellar, but free from frost. When weather moderates, unpack as above. Do not expose the roots to sun, air, wind or frost. If the trees have been delayed in shipment and have become badly shriveled, bury in moist earth and pour on water, keeping them wet a few days. When plump and fresh, plant at once. Refer to Fig. 140 and use the following directions.

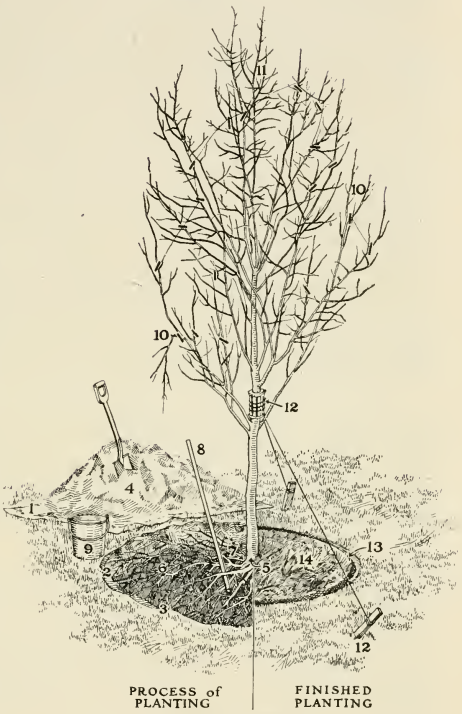


Fig. 140—The way to plant a tree.

(1) A piece of burlap or canvas should be spread over the grass, so that the dirt from the holes may be thrown upon it.

(2) Holes must be made so large that the roots may be spread out naturally without cramping. See also No. 6.

(3) Dig holes larger in circumference at the bottom than at the top to prevent water laying about the roots.

(4) Good, fertile top soil must be used about the roots. If the tree is to be planted in impoverished ground, good soil should be provided for it.

(5) Plant a tree just as deeply as it stood in the nursery row. This depth is very easily determined by the dirt line always shown at the bottom of the trunk. Failure to plant in accordance with this rule probably results in the loss of more trees than any other cause.

(6) Lay the roots out naturally and cut off all the broken or bruised parts. See also No. 2.

(7) Be sure to press earth firmly about the roots, especially about the crown (where the arrow points), so that every particle of the roots will be embedded in compacted soil.

(8) A tamping stick may be used to work the soil firmly about the roots. With small trees and plants the dirt will settle firmly if the plant is gently lifted up and down, when the hole is half filled, so that the dirt will work its way between the roots. Just before filling in all the dirt, press it firmly. Be sure that the dirt is well compacted, excepting three or four inches at the top of the hole, which should be loosened by occasional cultivation.

(9) If buds have begun to swell at time of planting, or if the ground is dry, watering when the hole has been three-quarters filled will not only moisten the roots but help settle the soil firmly about them. Should drought ensue afterwards, occasional watering will be necessary until the tree becomes established; watering is, however, frequently overdone and death from this cause occurs to trees and plants almost as frequently as from neglect to water.

(10) Trim broken or bruised branches, also two-thirds of the previous year's growth, because the roots in their disturbed condition cannot at the outset nourish as large a top growth as before they were disturbed by moving. Marks among the branches of the diagram show where this tree should be trimmed.

(11) It is often best not to trim the leader or central stem, as a forked tree may result. Hardwood trees, like the oak and beech especially, should not have their central leader trimmed.

(12) If the tree is large or in an especially exposed place where winds may loosen it, support it with wires and provide some protection where the wires come in contact with the tree trunk. A piece of burlap with a few sticks, is useful to prevent the wires chafing the tree where they come in contact with it.

(13) After planting, it is better to leave a cultivated area about the tree than to sod close to it. This cultivated area should be from three to five feet in diameter.

(14) Fertilizer, in the form of stable manure or compost, may be used, but should not come in direct contact with the roots. A mulch applied after the planting is usually the best way to supply this fertilizer, as it then also acts to conserve the moisture.

Placing the Trees

In places where there are strong winds, the trees should lean slightly toward the direction of the prevailing wind. Leaning the tree toward the southwest enables it to stand up against the wind and protects it from sunscald. However, it is probably not necessary to lean the tree if the heavy side is planted toward the wind. To determine the heavy side of a tree, balance it in the hand: the side which settles next the hand is the heavy side. Plant the heavy side toward the prevailing wind.

In planting, one man should hold the tree in position, firming the dirt which the other man throws into the hole. The dark ring on the base of the trunk shows the depth that a tree was formerly planted, and in transplanting, the tree should be placed about two inches deeper than before.

Pruning

Pruning is absolutely essential. This should be done any time between mid-summer and the time the buds swell in the spring. Very little equipment is needed: a small pruning saw (which will cost you from sixty cents to Two Dollars, according to the size or type), a good stout knife and a pair of pruning shears. Cut out any dead, broken or rubbing branches, suckers, or sprouts.

Currants or gooseberries, especially the latter, should be quite severely pruned, but take out only such wood as is over three years old, or new growth where it is too thick, as the best fruit is borne on two or three year old wood. All branches which droop over and touch the ground, should be cut off, and any which cross each other or rub together. Keep the gooseberries cut to a single stem or two, at the most.

Grapes require comparatively severe pruning. Where they have not been trained to a trellis by a regular system of pruning, that is, where the vines have been against a wall, house or even an arbor, the laterals should be cut back to within a few buds of the trunk.

In pruning, always keep an eye for "Black Knot" or diseased dark cavities. All holes should be dug out clear and filled with cement as soon as the weather gets warm enough for it to set without danger of freezing.

Root pruning is essential to the best results of planting trees. This consists in trimming off the broken and bruised ends. Any long, slender roots should be cut back to about eight inches. Make a slanting cut with a sharp knife, cutting from the under side so that the cut surface will rest against the soil. Cut off the ends of any bruised roots and trim off any dry fibrous ones.

How to Set Out Trees for an Orchard

There are two ways to lay out an orchard. First, is the old method of planting in squares, which was one so generally used in the past; the second is the new triangular method, which is far better. By the old method, trees were planted on the four corners of a square, by the triangular method, trees were planted on three corners of an equal sided triangle, and are so planned that the trees of any row are opposite the open spaces of the two rows adjoining it.

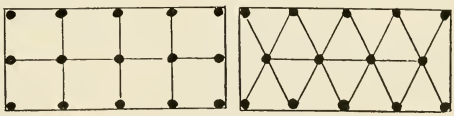


Fig. 141—Arrangement to plant trees.

By referring to the above illustrations, it will be seen that in both methods, the trees are an equal distance apart, but in the triangular method, the trees in the center rows can be planted closer to the top and bottom rows and at the same time all the trees will be the required distance apart. This method also permits of the cultivation in three directions instead of two, as in the old way. It also accommodates a greater number of trees to an acre.

The land should be well loosened and smooth on the surface. Dig the holes large enough to receive the roots easily without crowding and bending.

Orchard Fertilizer

All over the United States practical orchardists and various Experiment Stations are trying to determine the value of fertilizing materials in orchards. Some experiments tend to show that in certain soils no fertilizer is needed, while in other cases it has seemed to prove of great value.

It is, of course, impossible to recommend a fertilizer that would be ideal for all soils, but it is possible to give suggestive formulae.

In Bulletin No. 121, the Pennsylvania Station recommends the following general fertilizer:

Nitrogen—
30 lb. (N)
carried in
100 lb. Nitrate of Soda
and
150 lb. Dried Blood
or in
150 lb. Ammonium Sulphate.

Potash—
25 to 50 lb. (K_2O)
carried in
50 to 100 lb. Muriate
or in
100 to 200 lb.
of
Low-Grade Sulphate.

Phosphoric Acid—
50 lb. (P_2O_5)
carried in
350 lb. Acid Phosphate
or in
200 lb. Bone Meal
or in
300 lb. Basic Slag.

After studying the present available prices of fertilizer materials the following general recommendations for 1918 seem very reasonable:

1. A fairly liberal application of barnyard manure is the best fertilizer to use.

2. In a bearing orchard, where barnyard manure is not used, 200 to 300 pounds of acid phosphate per acre, with 1 to 2 pounds of nitrate of soda on trees indicating a need of nitrogen by pale foliage, small fruit, and continued small amounts of fruit.

3. On young trees ½ pound acid phosphate and 1 ounce nitrate of soda for each year the trees have been set. For example, a tree set three years would receive 1½ pounds acid phosphate and 3 ounces nitrate of soda.

4. The application should usually be made soon after the buds swell in the spring.

Spraying

Spraying is absolutely necessary to grow clean, first-class fruit. It has become as much an essential orchard operation as pruning, cultivation, etc. Spraying saves the crop this year and keeps the trees healthy so they can bear

good crops next year. Spray thoroughly—careless, insufficient spraying is worthless. Study the insects and disease and know what you are going to spray for.

By writing your state experiment stations, they will give you directions for spraying that will suit your particular case.

Spray and Other Formulas

To kill fungi on potatoes and fruit trees use:

Bordeaux Mixture.

5 lbs. copper sulphate (blue-stone).
5 lbs. fresh lime.
50 gallons water.

Suspend copper sulphate in a cheese-cloth bag, in 3 gallons of hot water in a wooden tub or earthen jar; pour into barrel and fill half full with cold water. Slake the lime in a separate tub, add 4 or 5 gallons water and stir freely. Pour this milk of lime thru a cheese-cloth or brass strainer, into the diluted copper sulphate, stirring constantly. Fill the barrel with cold water.

To kill plant lice, sucking insects, soft skinned worms, etc., use:

Kerosene Emulsion.

2 gallons kerosene. 1 gallon water.
½ lb. common soap.

Dissolve the soap in hot water, add the kerosene and churn all together until a white creamy mass is formed, which thickens on cooling. Dilute nine times before using.

To kill worms and biting insects use:

Paris Green.

¼ to ½ lb. Paris Green.
3 lbs. lime.
50 gallons water or Bordeaux mixture.

Mix the Paris Green with 1 pint of water, forming a paste; then add to the whole quantity of water. If used with Bordeaux mixture, the extra lime, mentioned above, is not required.

OR:

Arsenate of Lead.

1½ lbs. arsenate of lead (dry).
3 lbs. arsenate of lead (paste).
50 gallons water, or Bordeaux mixture.

Arsenate of lead is in the form of a thick white paste, which dissolves readily in water. It adheres to the foliage for a long time and does not "burn" the leaves.

To poison cut worms, grasshoppers, crickets, etc., use:

Poisoned Bran.

Mix 1 pound Paris Green or white arsenic with 20 pounds of bran. Add to 3½ gallons of water, juice and chopped pulp and skins of 3 oranges or lemons, also add 2 quarts of molasses. Mix the poisoned bran with the sweetened water. Use 4 or 5 pounds per acre, or more. Locate it chiefly in the line of march or travel.

Suggesting a list of varieties to solve your planting problems, the following list is generally found suitable for the several purposes mentioned.

Trees for Avenue and Suburban Planting:

American Elm
European Lindens
Horse Chestnut
Norway Maples
Oriental Plane
Pin Oak
Sugar Maple
Western Catalpa

Some vines for retaining banks and terraces:

Engleman's Ivy
Honeysuckles
Virginia Creeper
Wichuriana Rose and its varieties

Bright Berried Shrubs:

Barberries
Callicarpa
Coral Berry
Cornelian Cherry
Cotoneaster
Euonymus, Cork-barked
European Mountain Ash
Hawthorns
High Bush Cranberry
Honeysuckles
Oleaster
Snowberry

Dry and Shallow Soils—Plants for Shrubs:

Aralia Pentaphylla
Fragrant Bush Honeysuckle
Great Panicled Hydrangea
Japanese Bush Honeysuckle
Mock Orange
Privets

Trees—

Ash-leaved Maple
Black Locust
Catalpas
Mulberries
Poplars

Flowering Trees—

Black Locust
Crab Apples
Dogwoods
European Flowering Ash
Hawthorns
Horse Chestnut
Magnolias
Varnish Tree
Western Catalpa
Yellow Wood

Ground Covers—

English Ivy
Euonymus Radicans
Ferns
Mountain Pink
Periwinkle
Stonecrop
Yellow Root

Hedge Plants—Evergreens—

American Arborvitæ
Compact Arborvitæ
Parson's Compact Arborvitæ
Boxwood
Golden Retinospora
Green Retinospora
Silver Retinospora
Hemlock Spruce
Norway Spruce
White Spruce

Deciduous—

Altheas
Great Panicled Hydrangeas
Japan Barberry
Privets

Some Plants for Moist Places—Evergreens—

American Arborvitæ
Austrian Pine
Double Balsam Fir
Hemlock Spruce

Deciduous—

Alders
Blad Cypress
Red or Water Birch
Red Maple
Silver Maple
Sweet Gum
Willows

Shrubs—

Button Bush
Douglas Spirea
Elders
Hardhack
Osier Dogwoods
Spice Bush
Willow-leaved Spirea
Witch Hazel

Rapid Growing, Inexpensive Trees for Quick Results—

Ailanthus
American Ash
Ash-leaved Maple
Carolina Poplar
Lombardy Poplar
Oriental Plane
Western Catalpa
Willows

Plants for Seashore Planting—

This list is not advocated for ocean-front plantings, about which we invite correspondence.

Evergreens—

American Holly
Japanese Euonymus
Japanese Holly
Pines
Red Cedar
Savin Juniper
White Spruce

Deciduous—

Ailanthus
Catalpas
Chinese Cork Tree
Japanese Maples
Mulberry
Oriental Plane
Oaks
Poplars
Siberian Maples

Shrubs—

Altheas
Golden-leaved Elders
Hawthorns
Hydrangeas
Privets
Salt Bush
Spice Bush
Tamarisk

Vines—

Boston Ivy
Clematis paniculata
Honeysuckles

Some Plants Tolerant of Partially Shady Places—

Evergreens—

Andromeda
Azaleas
English Ivy
Mahonias
Mountain Laurel
Periwinkle
Rhododendrons

Shrubs—

Aralia Pentaphylla
Azaleas
Elder
Forsythias
Honeysuckles
Japan Maples
Mock Orange
Privets
St. John's Wort
Viburnums
Yellow Root

Street Trees for the City—

Ailanthus
Ginkgo
Norway Maple
Oriental Plane
Poplars, Carolina
Red Oak

Trees Especially Adapted for Windbreaks—

American Arborvitæ
Norway Spruce
Pyramidal Arborvitæ
Scotch Pine
White Pine
White Spruce

Deciduous—

European Cork Maple
European Beech
Hornbeam
Purple Beech

Shrubbery and Vines

SHRUBBERY, small trees and vines are essential to the proper decorations of the lawn and garden. We have found that it is a better plan to use more shrubbery and vines and less flowers for beginners.

Of the shrubs, azalias are the most satisfactory. Their range of brilliant colors and the large size to which they eventually grow, suit them well for the kind of gardening which is here taken up. Rhododendrons, both in their natural and cultivated varieties are also useful and the fact that they are evergreen makes them valuable for decoration in the winter. Altheas, or as they are more commonly known, "Rose of Sharon," bloom in August at a time when few other shrubs are in flower, and as they increase in age, the stems take on a gnarled and twisted appearance which is very attractive. The spirea, hydrangea, and snowberry are also excellent shrub varieties. No attempt can here be made to give anything like a full catalog of the better shrubs and flowers for planting. The few mentioned and those which most closely resemble them are spoken of only to illustrate the effect which one should aim for in gardens close to the house.

A garden should have a boundary high enough to insure privacy. For this purpose, one may have a fence, hedge or masses of shrubbery, trees, etc., which may be planted to form the necessary boundary.

The lawn should be large enough to provide some stretch of uninterrupted green. Arrange paths and make useable for damp weather and on dewey mornings. A place for outdoor lounging with plenty of shade as well as bloom, and so furnished as to encourage living in the open is a very desirable feature and should be interesting in winter as well as summer.

The boundary or walls of garden may be of various heights and widths. They may be of trees, shrubs, hedge-plants or of vine covered walls and fences. Their success depends upon the feeling of continuity and upon the amount of beauty and interest they can express. Even the boundary of a narrow lot need not be a matter of arbitrary success. The plainest board fence, if properly handled, can serve as a background for a garden border. It can be made a thing of rare beauty, with vines and flowers. There can be wistaria and trumpet vines for the posts, rose climbers or honeysuckle, Boston ivy or woodbine; for autumn reds, clematis, both purple and white, the turquoise berry, or if naught else the more than willing morning glory. The very wires and strings on which the vines are trained can be made a matter of pleasing design.

If the walls of the garden have interest of coloring or of bricklaying, if they can be made to give suggestions of well spaced piers or of cool concrete, a dark vine like the English ivy can be trained so as to adorn the wall.

Another attractive boundary for the garden is one of trees and untrimmed shade-loving shrubs, such as the viburnums and privets. Taller varieties of trees should be planted at the rear of the garden rather than at the sides, with, for instance, a row of trees for the very back, and smaller shrubs in front of them.

Many attractive color schemes can be worked out, with flower blooming trees and shrubs, such as snowball, lilac, hydrangea, snowberry, syringa, barberry, etc., should you desire a hedge border for the walls, the barberry will be found excellent for this purpose.

If the shrubs are to be arranged in groups or colonies, the area they are to occupy should first be thoroughly spaded and prepared as if for flowers, after which the planting may be done in the usual manner. A cultivated area between closely planted shrubs stimulates their growth and is easier to keep in order than grass, which succeeds poorly beneath their shade, and is, in such places, difficult to mow.

Trimming Shrubbery

Those shrubs that bloom before the middle of June bear their flowers on twigs of the previous season's growth. When these twigs are trimmed in winter, the very branches that would have flowers the following spring are destroyed and the bloom sacrificed. Trim such shrubs, if they need trimming, immediately after they have finished blooming, by removing dead twigs, cutting out short, weak ones and clipping back long, ungainly branches to preserve the natural, graceful form of the plant.

Shrubs like hydrangeas and altheas, which flower after the middle of June, carry their bloom on twigs of the same season growth. This growth and the number of branches that will bear flowers is increased by priming in winter, the season of the year in which all shrubs that flower after the middle of June should be trimmed.

Newly planted shrubbery should be cut back severely at time of planting. This treatment reduces the number of buds to be supplied with nourishment, and has a tendency to make the growth much more vigorous than if it were not so pruned. Generally from 1/3 to 1/2 of the top should be removed. While this may seem to spoil the shrub, it really is the making of it. The plant will be more bushy and can be trained, as it grows, into the shape of plant desired.

When shrubbery is planted in the spring, this trimming is perhaps most easily done before the plant is set in the ground. When planted in the autumn it is usually best to defer the trimming until early in the spring.

The Way to Plant and Trim Hedges

Dig a trench wide enough and deep enough to accommodate the roots without cramping (usually about 15 to 18 inches).

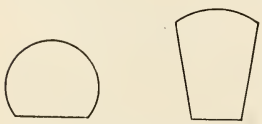


Fig. 142—Because the tops of hedges trimmed like these are broader than the base, sunlight does not reach the bottom branches.

If it is preferred to place well rotted manure in the bottom of the trench, dig it about ½ foot deeper than otherwise, and put in two or three inches of manure, shoveling over it a layer of top soil until the trench is refilled to the depth sufficient to admit proper planting. DO NOT LET ROOTS COME IN DIRECT CONTACT WITH MANURE.

It is a good practice to mulch the hedge often while being planted, so that the manure will conserve the moisture, and the strength-giving elements from it will percolate around and about the roots.

Place the plants so that their branches will touch one another, or, if a thicker hedge and immediate effects are desired set them even closer, so that their branches can interlace. Press soil firmly about the roots and otherwise plant in the usual manner.

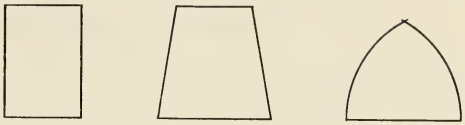


Fig. 143—Sunlight reaches the bottom branches of hedges trimmed like these, and they remain dense and healthy.

Probably more hedges become thin and ugly at the base for want of sunlight than from any other cause. This condition is often the cause of trimming improperly. In Fig. 142 the tops of hedges trimmed like these are broader than the base. Sunlight does not reach the bottom branches.

On hedges trimmed, as shown by Fig. 143, the sunlight reaches the bottom branches and the hedges remain level and healthy.

Twenty Shrubs for General Effect

The berried shrubs are winter features; only those which hold berries all winter are mentioned.

Blooming in April

Daphne Mezereum—Three feet high; lilac flower.
Forsythia Fortunei—Eight feet; yellow flowers.
Cercis Japonica—Twenty feet; rosy-pink flowers.

Blooming in May

Berberis Thunbergii—Four feet; yellow (berries).
Prunus triloba—Five feet high; pink flower.
Lonicera Morrowi—Six feet; white flowers.
Spiraea Van Houttei—Eight feet; white.
Viburnum opulus—Twelve feet; white (berries).
Syringa vulgaris—Twelve feet; white and lilac.

Blooming in June

Potentilla fruticosa—Three feet; yellow.
Philadelphus Pekinensis—Five feet; creamy.
Diervilla floribunda—Eight feet; crimson.
Cornus sanguinea—Twelve feet; white (berries).
Crataegus Crus-galli—Twenty-five feet; white.

Blooming in July

Spiraea tomentosa—Four feet; purple-pink.
Hydrangea quercifolia—Six feet; white.
Amorpha fruticosa—Ten feet; blue.

Blooming in August

Callicarpa Japonica—Four feet; pink.
Hibiscus Syriacus—Twelve feet; white and pinks.

Blooming in September

Caryopteris mastacanthus—Four feet; blue.

Ten Shrubs Furnishing All-Summer Bloom

April

Forsythia Fortunei—Yellow, eight feet.

May

Azalea calendulacae—Flame; six feet.
Azalea Vaseyi—Rosy white; seven feet.
Spiraea Van Houttei—White; eight feet.

June

Diervilla floribunda—Crimson; eight feet.
Azalea arborescens—Pink; eight feet.

July

Clethra alnifolia—White; six feet.
Tamarix Gallica, indica—Pink; fifteen feet.

August

Hibiscus Syriacus—White; pink; twelve feet.

September

Caryopteris mastacanthus—Blue; four feet.

A Planting for Winter Beauty

Blooming in April

Andromeda floribunda—White; four feet; evergreen.
Azalea amoena—Claret; five feet; evergreen.
Cornus Mas—Yellow; twenty feet.

Blooming in May

Berberis aquifolium—Yellow; four feet; evergreen.
Berberis Thunbergii—Yellow; four feet.
Berberis vulgaris—Yellow; six feet.
Leucotheo Catesbaei—White; six feet; evergreen.
Lonicera fragrantissima—Cream; eight feet; half-evergreen.
Viburnum opulus—White; twelve feet.

Blooming in June

Kalmia latifolia—Pink; eight feet; evergreen.
Cornus Amomum—White; ten feet.
Cornus sanguinea—White; twelve feet.
Rhododendron—Pink, white, mauve; eight to thirty-five feet; evergreen.

Blooming in July

Rhododendron, in certain varieties.

Blooming in August

Calluna vulgaris—Pink; two feet; evergreen.

Also

Ilex opaca—Twenty feet; red berries; evergreen.
Ilex aquifolium—Twenty feet; red berries; evergreen.
Rosa Wichuraiana—Trailing; red hips.
Rosa lucida—Six feet; red hips.

A Rose Garden

WHEN one considers the fact that there are over four thousand species of roses, it will readily be understood that this chapter can give but a rough working knowledge of the groups and species. If there is any secret in connection with the growing of beautiful roses in abundance, it lies in the strict observance of a few fundamental principles thru which the rose plants, or bushes, are given a location and soil which they will find congenial and nourishing. Be generous in the amount of thought and care you give in producing health, food and strength for your rose plants, and as a result you will have to give very little thought and care to curing disease and killing off the rose bugs and slugs.

Location

In selecting a location for your Rose Garden, the ideal location is to be found neither on a hilltop where the winter winds will play havoc with your winter protection, nor in a low hollow where frosts are always more frequent. A rose garden must be kept away from any tree. It is generally known that the root system of a tree will spread out as far from the base as the height of the tree and takes up all the moisture in the ground. Therefore, we will have to use the wall of a house or a garden wall for protection.

Sun is very essential, though it will be found that if the beds are in shade for the first part of the morning, one will have the opportunity of enjoying the roses at their best, before the dew has been taken from their petals by the sun. Make your rose garden a separate garden; do not crowd in or near any other plant or vine.

Preparation and Planting

Now as to preparation of the rose bed itself: First of all, dig the soil out to a depth of two feet at least, keeping the top soil and sods, and the sub soil in separate piles as they are taken out. Loosen up the floor of the trench with a pick, and on this, if the ground needs draining, which it will if it is a compact, sodden surface, put a layer of stones, cinders and other material that will not decompose. On top of this, place the best of the sub soil mixed with a generous dressing of well-rotted manure, finally all the sod, well broken up, and the top soil, also enriched with manure. Then fill in the bed with enough good top soil to bring it two or three inches above the adjoining surface. Make sure that the surface bed, after it has settled, will be about one inch below that of the adjoining sod in order to retain the moisture from rain. This preparation of the bed should be done at least several weeks in advance of planting time.

In composing the soil for the rose bed, it is well to remember that the Hybrid Perpetuals require a heavy soil containing some clay. For Teas and Hybrid Teas a lighter, warmer soil is better.

Top soil from an old pasture, if it be a moderately heavy loam, taken with the grass roots and chopped very fine, will do excellently for the Hybrid Perpetuals. For the Teas and Hybrid Teas, mix with soil of this kind about ¼ of its bulk of sand and leaf mold to lighten it. Remember that all the manure that is used should be incorporated with the lower two-thirds of the

bed; the upper third should not contain any recently added manure as it is apt to harm the roots of new plants.

If spring planting is chosen the plants must be put in the ground early, at the first opportunity, so that they will have time to become firmly established before hot weather.

Pot grown plants from green houses cannot, of course, be set out until all danger from frost is past.

Before setting the plants, examine each carefully and cut off all the broken roots with a sharp knife, as well as all eyes that may appear on the root stock, in order to forestall suckers. They should be set immediately upon their receipt from the nurseryman, so that the roots will not dry out. If they seem dry it might be well to puddle the roots in thin mud just before setting. Make the holes large enough to accommodate all the roots without crowding, remembering to put the budding point not less nor more than two inches below the surface, and with the roots spread out almost horizontal, but inclining downward toward their ends and without crossing one another. This will not be an easy matter, for in shipment the roots will have previously been so compressed that they extend almost directly downward from the collar. After the plant has been firmly set and the earth carefully packed in around the roots, rake the soil to loosen it up over the whole surface.

With the pot grown plant, the moist ball of earth that comes about the roots is carefully retained intact and placed in the hole prepared for the plant. Set the plant firmly in place by pressure with the soles of your shoes, give a generous watering, and finally break up the surface of the soil with a rake.

It is absolutely essential to keep the surface of the ground loosened with a hoe and a sharp steel rake, thruout the summer. After very hard rain loosen the soil as soon as it is dry enough to work, to conserve the moisture.

Fertilizing

In contrast to the beauty of the rose, is the food that we must give it in abundance if we would have the most healthy plants.

The theory of this manurial feeding will make clear the fact that a proper application of liquid manure has practically all the advantages of the solid method without its drawbacks. For solid manure, if applied to the beds in quantities sufficient to be of real value, has a tendency to keep the needed air out of the top soil and to bring in its train an abundance of weeds that will be hard to exterminate. So that with the exception of light sandy soils, where the humus is needed, we shall do well to feed the rose garden liquid nourishment.

The time when this stimulant will be most effective is in the months of May and June, when most of the plants are putting all their efforts into the forming buds. Withhold the liquid in dry spells, for it is most appreciated immediately after a good soaking rain.

Avoid getting the manure on the foliage and make sure that it errs on the side of weakness rather than strength. Suspending a burlap sack containing a bushel of cow manure in a barrel of water for two days, will give a solution that needs dilution with its own bulk of water. A half gallon to a plant each week will be a sufficient normal feeding.

Immediately after dosing the beds, go over them with a rake or prong hoe and loosen up the surface to prevent evaporation.

Pests

By far the most effective campaign against the insects and other pests that infest rose plants is to be found, not in sprayings and dustings, but rather in maintaining to the best of our ability a condition of health in the plant itself. Prevention here, as always, is better than cure. Nor can it be too strongly emphasized that the daily use of a powerful, but finely divided spray from the hose will make life on the rost plant miserable for practically all the parasites. The following are the chief enemies that we may find in the rose garden.

Alphis or Green Fly

The alphis is a small, pale green louse, winged or wingless, with a soft, fat, oval body, apparently too heavy for its legs. To exterminate it, use tobacco smoke. If spray is found more convenient, a solution of four ounces of cheap tobacco stem boiled ten minutes in one gallon of soft water is effective. Strain the solution and four ounces of soft soap while it is still hot, stirring well to dissolve the soap.

Mildew

Dusting flowers of sulphur upon the foliage, taking care to reach the under side of the leaves as well as the upper and upon the ground about the plant, is a well established remedy.

Rose Thrip

This is a small, yellowish white insect, with transparent wings, usually found on the under side of the leaves.

Spray with tobacco solution. If this does not prove effective, dust the under side of the leaves with white hellebore in a powder gun. Whale-oil soap solution in the proportion of five ounces of soap to one gallon of water, is a good remedy.

Rose Caterpillar or Leaf Roller

Several kinds of caterpillars may appear, varying from ½ to ¾ of an inch in length and either green, yellow or brown in color. They have a habit of enveloping themselves in the rose leaves, or boring their way into the flower buds. In the latter case, they are very apt to be overlooked.

Powdered hellebore will hinder their progress, but by far the most effective weapons are the fingers and thumbs.

Rose Chafer or Rose Bug

This brown beetle, less than one-half an inch in length is one of the best known rose pests. It is a slow moving creature that appears suddenly in armies in the blooming season in June and is the more annoying for the reason that it elevates its attention almost entirely to the flowers themselves.

Paris green dusted over the plants will kill the pest. Knock the creature off the flowers into a tin of kerosene and then burn it.

Rose Slug

This is the larvæ of a sow fly which comes up out of the ground in May and June. The female makes incision in the leaves and deposits her eggs, which hatch in about two weeks. The slugs will eat an astonishing amount of leaf if not checked. They are about a half inch long, green and will be found on the upper side of the leaf.

Powdered white hellebore, dusted on the foliage, or the solution of whale-oil soap mentioned for the Rose Thrip, will keep it in check.

White Grub

This is an underground enemy that feeds on the roots of the Rose bush. The withering or sickliness of the plant is sufficient reason to cause a thorough search to be made by lifting it. The grub, which is prouded with six legs near the head, and which coils itself into a crescent shape when in repose, is particularly fond of strawberry plants, so it will be well to keep those some distance from the rose garden if you have any planted.

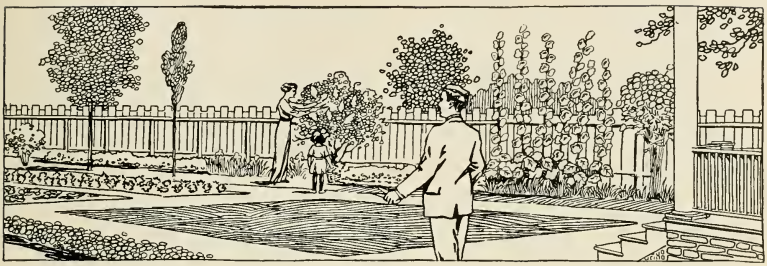
About the only thing that can be done with the White Grub is to lift the plant and remove it.

Black Louse or White Scale

This appears when the bush is grown in a shady, damp place. It is snow white and the individual scales are about one-tenth of an inch in diameter. Cut off and burn badly infested shoots. Spray with one pound of soap in one gallon of water in early winter and again in early spring. Weaker summer applications may be used also; one pound to four or six gallons of water, once in three weeks, thruout the season will help.

Helpful Animals in Rose Gardens

The toad, lady bug, ground bird, and swallow will help wage war on the pests of the rose bush. It may be well to scatter a few crumbs in the rose garden to attract birds there, not too many, but just enough to create a real appetite for the insect pests.



Flowers

THERE are three great classes of plants, of flowering plants, let us say, from which a garden may be stocked; these are perennials, biennials, and annuals. Perennials, once established, either from seed or root, persist and bloom year after year; biennials start from seed one year, do not bloom until the next and then die at the end of the second year; annuals come from seed, mature, blossom, produce seed and die, all in one year, or more accurately speaking, in one summer.

Flowers, more so than any other form of nature life, must have the proper attention and food. They must be looked after from early spring till the seeds are ready to pick in the fall, or they are ready to be covered for the winter.

Careful study and preparation should be made for the different kinds of plants you wish to use.

Soil in which seeds are to be sown cannot be too fine and delicate in texture, and all things considered, more seeds fail because of unsuitable soil than from any other cause. It makes no difference how sturdy a plant will become when it grows up, it starts as a tender, wee infant; and its puny strength must not only send the imprisoning earth above it, but it must put forth the arms with which this is going to be done. The less vitality that need be used, therefore, in breaking thru, the more there is to use in growing, hence the greater vigor, the more luxuriant growth, and greater strength.

Very rarely is even a good garden soil quite the ideal soil for starting seeds in boxes, for it is not mellow enough. Rotted sod is the skilled gardener's hobby—sod taken from rich old roadsides, where grass grows thick and soft,—but this is not to be had for a this-year garden. So the next best thing, which is the scraping from the under part of a good rank sod, must be taken. Scrape with a rather sharp metal edge, thus breaking all the root particles up into a fine mass. Screen one part of this soil to one part of dry leaf mold from the woods, or two parts of the soil to one part of thoroughly rotted, fine manure, thru a quarter-inch mesh sieve. A wire basket, such as the household departments sell for lowering eggs or potatoes into a kettle to boil, is just the thing. Then add sand enough to the mixture to make it

crumble apart readily, even when moistened. Usually one-third sand is about right.

Flats made from cracker boxes are just right in size and weight and two boxes will make several. Cut one into three-inch sections lengthwise: the top section, with the cover nailed on it, is already one flat, the bottom section another. Onto one side of the other sections nail bottoms made from the other box; bore half a dozen holes in the bottom of each of them for drainage and they are ready.

Cover the bottom an inch deep with, first, a layer of cinders or gravel —anything that will be loose and stay so; then put screenings over this. On top of this drainage layer spread the prepared soil and jounce the flat onto the table to settle it all well. Sow the seeds according to the directions which each packet bears, covering them usually to the depth of their own diameter. Some give them twice this cover, but a little is better than too much. Sift the earth onto them and pat it down gently with a float or flat board, or the hand, held very flat. The float is better, because it leaves no little furrows into which even a little water can wash the seeds.

Soil that has been well watered the day before planting is in just the right state of moisture to receive seed and to be sprinkled over them. Water the flats after seeding, either with a fine sprayer that will spread the moisture in a mist, or else thru two or three thicknesses of coarse cloth, like burlap, with a watering-pot. This is to prevent the force of the water from washing the seeds out and messing things up generally, as it most certainly will if poured from the pot directly upon the soil.

Put the flats in a warm place; a sunny window will do if direct sun is kept from the earth surface by means of a semi-transparent curtain, and keep them evenly moist—NOT wet—until the seedlings are above the surface. After they appear keep very careful watch upon their moisture supply and water them whenever the soil is dry, before they have had a chance to wilt. Give as much water at such times as the soil will take up—then do not water again until it once more looks dry. And be very careful to keep the little plants themselves dry—their stems and leaves.

Transplant them to flats an inch deeper than the original seed flats, or flats having an inch more earth in them, or to pots (the little paper pots are a great convenience, especially when setting out finally), when the second true leaf appears, unless the directions on the packet stipulate differently. Water the soil (this must be similarly prepared) into which they are to go, the day before transplanting, and, likewise, water that in which they already are planted. Then they will loosen readily from it. Take them up by shoving a knife or trowel down at the edge of the flat and loosening a chunk of earth, plants and all. Then crumble this gently apart in the fingers, detaching the little roots carefully. They will come out quite easily this way, with seldom a fracture of even the most delicate.

Set each little plant into its new quarters with the aid of a dibble, a round tapering-pointed affair made from eight inches of old broom-handle, sharpened to a slim point, the slimmer it is the better, for tiny seedlings. Or something much smaller may be used—any stick whittled down to this form; the large form is necessary for heavy work, but a match will serve for this kind. Thrust it down into the earth to make the hole to receive the plant and make this as deep as the length of the roots, plus half the stem. Lower the

little plant into it until only half the length of its stem remains above ground; then press the dibble into the soil again, an inch from the first hole, and crowd the earth over and against the roots by tilting the top of it. Firm it finally by pressing lightly down on each side of the stem with the balls of the thumbs, but do not pack it as tightly as you can. The idea is to get all the little root hairs in contact with earth and to do this without dragging against them from any direction; and this final pressure down is only to close up all gaps in the earth that may be anywhere about the plant, not to push it down into the earth.

Water the soil thoroughly, not the tops of the plants, after transplanting, and then give the seedlings all the fresh air possible, without chilling them, all the time. Remember it is the breath of life to them as well as to us. Water them whenever the soil looks light colored and dry on top, not oftener, and shade from the noonday sun for a day or two after transplanting.

Cut flowers for the house should have freshly cut stems in order that the water can gain access to the cell walls of the stem thru the action of osmosis.

Keep your flower garden free from weeds, not only for the purpose of beautifying it, but keep them from crowding the plants and taking the moisture from the ground. Plants must be kept free from dead leaves and flowers, and it is also a good plan to keep the blossoms well picked off on plants such as pansies, sweet peas, nasturtiums, etc.

As we stated before, the beginning of the garden is almost the most important part, but care and work is also necessary on the garden in the fall. If your garden has been a success, gather the seeds and take up the bulbs for the next season and remove the dead plants, etc. Fertilize the ground in the proper manner.

Comparative List of Annuals

Trailing and up to six inches in height

Ageratum—Floss Flower; light and dark blue, also rose; start indoors; set out May 1.

Alyssum Mad-wort—All varieties white; start indoors or early outside.

Ionopsidium acaule—Diamond Flower; violet; sow out in May; cool moisture.

Lobelia compacta—Lobelia; white, blues, maroon; start indoors, set out May 1.

Phlox Drummondi; nana compacta—White, pink, scarlet; start indoors or out.

Portulaca—Sun Plant; various; likes poor soil; sow late May, outside.

Sanvitalia procumbens, fl. pl.—Bright yellow, double flowers; start indoors or out.

Silene pendula compacta—Catch-fly; white, pink, red; sow fornightly, April 1 to July.

Six inches to fifteen inches

Adonis aestivalis—Pheasant's eye; crimson; sow in March; set out May 1.

Ageratum—Imperial varieties; white, blue; start indoors; set out May 1.

Asters—Dwarf and Waldersee varieties; various; lime the soil in beds; sow in March-April; set out May.

Calendula—Marigolds; white, yellows, reds, browns; start early indoors or out.

Phlox Drummondi, grandiflora—White, pink, lilac, red, yellow; start indoors or out.

Calliopsis—Yellow, crimson, red-brown, brown; start outside; thin out.

Candytuft—White, rose, lavender; sow fortnightly, April 1 to July 1.

Dianthus—Annual pinks; various; start indoors; set out May 1.

Eschscholtzia Californica—California Poppy; white, orange, rose, scarlet; sow only in the ground.

Gomphrena—Globe Amaranth; red, yellow; "everlastings;" start indoors or out.

Gypsophila—Baby's Breath; white, pink; sow fortnightly, April 1 to July 1.

Linum coccineum—Scarlet Flax; scarlet; start indoors; set out May 1.

Pansies—Various; start indoors March.

Schizanthus—Butterfly Flower; various; sow from April 1 fortnightly.

Schizopetalon Walkeri—Maze Flower; white; sow outdoors in permanent location.

Fifteen inches to twenty-four inches

Acroclinum—Everlastings; white, pink; single and double; sow indoors or out.

Antirrhinum—Snapdragons; white, yellow, pink, scarlet, etc.; start indoors in April.

Asters—Giant Comet type; peony-flowered type; tassel or Japanese aster.

Calliopsis coronata—Pure yellow; sow in permanent location; thin out.

Carnations—Marguerite type; white, yellow, rose, crimson; start indoors in April.

Centaurea imperialis—Sweet Sultans; white, rose, purple; start seed indoors in April.

Gaillardia—Blanket Flower; brilliant crimson, orange, etc.; sow where they are to bloom.

Matricaria Capensis—Feverfew; white; start indoors or out.

Nasturtiums—Bedding varieties; yellows, browns, scarlets, etc.; sow outdoors.

Petunia (save weakest seedlings)—White, pinks, reds, variegated; start indoors; set out May 1.

Saponaria vaccaria—Bouncing Bet; pink; start in April; set out in May.

Salpiglossis—Painted Tongue; white, rose, crimson, purple, gold; start in April; set out in May.

Vinca rosea—Periwinkle; white, rose, mixed; start indoors; set out in May.

Wallflower—Yellows and yellow-reds; start in March; set out April 20.

Twenty-four inches to thirty-six inches and up, as noted

Arctotis grandis—African Daisy; white, lilac beneath, large; start indoors in April.

Asters—Late, branching type; various; start indoors in April.

Balsams—Lady Slipper; white, pink, violet, etc.; start indoors in April.

Bartonia aurea—Golden Bartonia; golden-yellow; sow in May in permanent location.

Chrysanthemums—Garden type; white, yellow, and various; start indoors in April.

Cleome pungens—Spider Flower; rosy-lilac; start indoors or out.

Cosmos (grows to seven feet)—White, pinks, crimson; start indoors; set out May 1.

Datura—Trumpet Flower; white, yellow; start indoors; set out May 1.

Delphinium ajacis—Larkspur; white, pink, blue, lilac, dark blue; start early indoors or out.

Mirabilis Jalapa—Four O'clock; various; sow where they are to bloom.

Papaver—Annual Poppies; white and various; sow where they are to bloom, as they seldom survive transplanting.

Scabiosa—Mourning Bride; white, pink, red, lilac, purple; sow indoors or out.

Stocks—Cut-and-come-again; white, yellow; rose, blue, red, lilac; start in March; set out April 20.

Zinnias—Youth-and-old-age; white, pink, yellow, red, etc.; start in April; set out May 1.

Annuals for Shady Places

Under twelve inches

Adonis aestivalis (already described).

Asperula azurea setosa—Sweet Woodruff; lavender-blue; start indoors or out.

Nemophila—Love Grove; various; start indoors in March; must have cool place and not rich soil.

Twelve inches to twenty-four inches

Fuchsia—Fuchsia; coral; well known; start indoors; also house plant.

Twenty-four inches up

Clarkia—Clarkia; white, salmon, pink; start indoors or out.

Lupinus—Lupines; various; start indoors or out.

Annuals for Sandy or Poor Soil

Under twelve inches

Abronia umbellata—Sand Verbena; rosy lilac; start indoors or out; trailing.

Mesembryanthemum—Ice Plant; various; start indoors or out; dry soil.

Portulaca—Sun Plant; various; sow outdoors, late May.

Twelve inches to twenty-four inches

Antirrhinum (already described) will grow in a light soil, but does not necessarily prefer it.

Godetia—Godetia; white, red, pink; start indoors or out.

Twenty-four inches up

Amaranthus—Love-lies-bleeding; red; start indoors; set out in May.

Celosia cristata—Cockscomb; crimson or variegated; start indoors or out.

Annuals for Boundaries

Cleome pungens, gigantea — Giant Spider Flower; rose, lilac; forty inches high; start indoors.

Mirabilis Jalapa (already described).

Foliage Plants

Kochia tricophylla—Summer Cypress; green to scarlet; thirty-six inches high; sow outdoors.

Pennisetum longistylum—Fountain Grass; greenish-white; twenty-four inches high; sow outdoors.

Pennisetum Rueppelianum—Green, purple plumes; thirty-six inches high; sow outdoors.

Ricinus Borboniensis—Castor Bean; green foliage; fifteen feet high.

Ricinus Phillippiensis—Very large leaves; ten feet high.

Ricinus sanguineus—Red stalks and fruit; eight feet high.

Ricinus Cambodgiensis—Black stems; foliage changing; five feet high.

Ricinus Gibsoni—Deep red foliage; five feet high.

Annual or First-Year Vines

Adlumia cirrhosa—Climbing Fumitory; pink; July; for trellises, trees, etc.

Bryonopsis laciniosa—Small Gourd; fruit ornamental; for trellises or arbors.

Cardiospermum Halicacabum—Balloon Vine; inconspicuous flowers; trellises or arbors.

Cobaea scandens—Cups-and-saucers; purple; July; start indoors in April.

Convolvulus major—Morning-glory; various; July on; arbors, etc.

Dolichos Japonica—Hyacinth Bean; white, purple; July; trellises, etc.

Echinocystis lobata—Wild Cucumber; white; July; arbors, trellises, etc.

Humulus Japonica—Japanese Hop; inconspicuous; screens, trellises, arbors, etc.

Sweet Peas—Get orchid type; various; plant in trench and "hill up."

Bulbs

BULBS will indeed grow almost anywhere; but wherever they are and whatever conditions of moisture they may like, always remember that a bulb itself must have free drainage.

However wet the location into which they are to go, and however heavy and muck-like the soil, this is readily accomplished by setting the bulb onto a cushion of sand or of fine coal ashes. This cushion may be shallow or deep according to conditions, the denser soil and greater moisture requiring the deeper layer of loose drainage medium. True bulbs, especially those of the open, scaly class, should be bedded upon a two or three inch layer; indeed it is well to bring an inch wall of sand up around such as these, leaving only the top to come in contact with the soil. The roots which the bulb puts forth will go thru the sand, of course, immediately, in their search and reach for moisture, while the bulb remains safe and snug and dry.

Fertilizer is appreciated by all bulbous plants, but manure ought never to touch a bulb of any kind. Usually the gardener is advised to apply cow manure liberally and spade the ground very deep, then grow something else for a season before planting the bulbs. This insures the decay of the manure but it delays the garden; consequently it is not a method with which one has much sympathy.

Bone meal is really the safe and, therefore, the best thing to use, when the bulbs are being planted. It may be mixed into the earth below and around each one, and worked in over the surface after they are buried. Once they are underground and established, however, well rotted cow manure may be applied to the ground above them, and worked in each spring; or even left to lie loose on the ground. It will leach thru the soil under the rain, and enrich it down to where the feeding roots are.

Bulb plants are different from all others in that they make and store away each season's bloom during the preceding season. This is the process that is going on when we speak of the bulb's "ripening;" and unless it is absolutely uninterrupted, no flowers can be produced during the succeeding year. Every bulb, as it comes from the ground in a dormant state, contains next season's flowers, every one of them—tiny, rudimentary embryos to be sure, yet nevertheless, the actual blossoms. Bulbs that do not, are immature and cannot bloom until they have been given time and opportunity, in the ground, to reach maturity.

Hardy Bulbs

Blooming in January, February or March

Galanthus nivalis—Snowdrop; white; plant in September, under trees or in cool shade under 2 in. of earth; set bulbs 1 in. to 2 in. apart; scatter by hundred or thousands; 3 in. to 4 in. high.

Galanthus Elwesii—Giant Snowdrop; white; as above, only cover bulbs with 3 in. of earth; the double variety will extend the season of bloom; 6 in. to 9 in. high.

Blooming in March

Anemone blanda—Grecian Anemone; blue; plant in fall, under 2 in. of earth; set bulbs 4 in. apart; likes rocky heavy soil; said to bloom earlier when facing the west; 4 in.—6 in. high.

Eranthis hyemalis—Winter Aconite; yellow; plant in autumn under 2 in. of earth; likes half shade and will grow under deciduous shrubs; 5 in.—8 in. high.

Crocus—In variety; crocus; various; plant in September under 2 in. to 3 in. of earth; likes well drained open soil, no manure; use named varieties rather than the Dutch hybrids; 3 in.—5 in. high.

Chionodoxa Lucilaea—Glory-of-the-Snow; white, rose, principally blue; plant in September under 3 in. of earth; set bulbs 1 in. to 2 in. apart; use in quantity; any ordinary soil not too dry; 3 in.—6 in. high.

Scilla bifolia—Squill; blue, also a white and rose; plant in September under 3 in. of earth; set 1 in. to 4 in. apart; use in quantity (avoid var. Peruviana); 4 in.—6 in. high.

Puschkinia Libanotica—Striped Squill; blue and white; plant in fall, same as Scilla; 10 in. high.

Blooming in March and April

Erythronium Americanum—Dog's Tooth Violet, adder's tongue; yellow; plant in fall under 6 in. of earth; likes light soil and part shade; 10 in. high.

Leucojum vernum—Spring Snowflake; white; plant in fall in masses, under 3 in. of earth, 4 in. apart. Rich soil. 12 in. high.

Blooming in April

Narcissus pseudo-narcissus—Daffodil, trumpet Narcissus, Lent lily; yellow; plant in fall under 3 in. of earth; do not disturb after once established; likes deep soil and semi-shade, but thrives everywhere; the double forms of this are what in America we commonly call daffodils; 12 in.—18 in. high.

Narcissus jonquila—Jonquil; dark yellow; plant same as above; 12 in. high.

Fritillaria Meleagris—Snake's Head, checkered lily; cream and purple; plant in fall, under 3 in. of earth; likes warm, sandy loam; lift and divide every 3 years when in border, but do not touch when naturalized; 10 in. to 18 in. high.

Muscari Botryoides—Grape Hyacinth; purple; plant in fall under 2 in. of earth; any ordinary soil; 6 in. high.

Muscari comosum. monstrosum—Feathered Grape Hyacinth; claret purple; plant same as above; 12 in. high.

Muscari Moschatum—Musk Hyacinth; blue; same as above; 12 in. high.

Hyacinthus orientalis—Hyacinth; various; plant early in October under 5 in. of earth, in soil worked to depth of 15 in.—12 in. high.

Tulipa suaveolens—Tulip; various; plant in fall, under 4 in. of earth; the double varieties remain longer in bloom than the single; 12 in. high.

Anemone coronaria—Poppy Anemone; white, scarlet, purple; plant in November under 2 in. of earth; prefers sandy loam but thrives in ordinary soil; 6 in.—12 in. high.

Muscari Botryoides—Carneum; pink grape hyacinth; pink; same as other Muscari; 8 in. high.

Blooming in April and May

Leucojum aestivum—Summer Snowflake; white, tipped with green; same as Leucojum vernum; 12 in. high.

Narcissus poeticus—Poet's Narcissus; white; plant in fall under 3 in. to 4 in. of earth; will not do well in very dry or poor soil, as disease attacks it under such conditions; likes deep, rich loam; 12 in.—18 in. high.

Blooming in May

Tulip turcica—Parrot Tulip; various yellows and scarlets; plant in November under 2 in. of earth; prefers a light, sandy soil, but thrives anywhere in full sun; 6 in. to 12 in. high.

Tulipa Gesneriana—May-flowering Tulip; various; plant in September under 3 in. of earth, in soil worked to a depth of 15 in., on a cushion of sand; prefers sandy loam, but thrives almost anywhere; 6 in.—24 in. high.

Ornithogalum umbellatum—Star of Bethlehem; white; plant in fall, under 3 in. of earth; thrives in any soil, poor or rich; 12 in. high.

Fritillaria imperialis—Crown Imperial; red, yellow, orange; plant in fall, under 6 in. of earth on a 1 in. layer of earth above 6 in. of rich manure; likes warm, sandy loam; locate where shady at noon; group by twos, threes or more, and do not disturb; 2 ft. to 3 ft. high.

Fritillaria recurva—California Fritillaria; scarlet lined with yellow; treat same as Fritillaria Meleagris; 24 in. high.

Trillium grandiflorum—Wake Robin, wood lily; white, changing to rose; plant in August or later in deep, loamy soil, under 4 in. of earth; likes shade and moisture; native of woods; 10 in. to 12 in. high.

Scilla campanulata—Wood Hyacinth; blue; plant in fall in partial shade; endures very poor soil; treat same as Scilla; 6 in. high.

Allium aureum (Allium Moly)—Golden Lily Leek; yellow; plant in September under 3 in. of earth; any ordinary soil; 10 in. high.

Blooming in May and June

Iris Xiphium—Spanish Iris; various; plant in September under 3 in. of earth. 6 in. apart; lift about every third year as new bulbs form beneath the old; likes moisture; 18 in. to 24 in. high.

Blooming in June

Allium azureum—Blue Lily Leek; blue; plant as Allium aureum; 24 in. high.

Iris Xiphioides (or Anglica)—English Iris; white, purple; plant in fall, same as Iris Xiphium; any good soil, not necessarily moist; 24 in. high.

Eremurus robustus—Desert Lily; pink; plant in October under 3 in. of earth, in deep, sandy loam, enriched with cow manure; locate in sunny place; give winter cover to protect the early spring shoots; 6 ft. to 10 ft. high.

Eremurus Himalaicus—White Desert Lily; white; plant as above; leaves of Eremurus disappear after it has flowered; 4 ft. to 8 ft. high.

Lilium longiflorum—White Trumpet Lily; white; plant in November under three times the bulb's depth of earth, after working the ground twice as deep; set on cushion of sand and cover with sand; locate where ground is shaded from midday sun; 2 ft. to 3 ft. high.

Lilium candidum—Madonna or St. Joseph's Lily; white; plant in August (or before Sept. 15) under 4 in. of earth; always dust the bulbs first with powdered sulphur; set in 3 in. pocket of sphagnum moss; 2 ft. to 4 ft. high.

Iris Laevigata (Kaempferi)—Japanese Iris; various; plant in November under 3 in. of earth; succeeds anywhere but likes deep, rich, moist soil; 2 ft. to 3 ft. high.

Blooming in June and July

Hemerocallis auriantica—Yellow Day Lily; orange yellow; plant in fall under 3 in. of earth; any soil, but prefers part shade; this is hardier than var. major; fragrant; 2 ft. to 3 ft. high.

Hemerocallis Florham—Golden Day Lily; yellow; as above; fragrant; 2 ft. to 3 ft. high.

Hemerocallis flava—Lemon Lily; pale yellow; as above; fragrant; 2 ft. to 3 ft. high.

Blooming in July

Hemerocallis fulva—Tawny Lily; orange; as above; not fragrant; 2 ft. to 3 ft. high.

Calochortus venustus—Mariposa Tulip; white, yellow, purple; plant in late autumn under 2 in. to 3 in. of earth, in well-drained, light soil and partial shade; mulch well in fall; 10 in. to 20 in. high.

Blooming in July and August

Hemerocallis Thunbergii—Yellow Day Lily; lemon yellow; same as other Hemerocallis; fragrant; 2 ft. to 3 ft. high.

Blooming in August

Lilium aurantum—Gold-banded Japanese Lily; creamy, gold bands, purple spots; plant in fall in 3 in. pocket of sphagnum moss; mulch with leaves to protect ground from sun, or set where ground is shaded; 4 ft. to 6 ft. high.

Lilium Henrui—Lily; yellow, green-banded, brown spots; as other lilies; 3 ft.—5 ft.—8 ft. high.

Lilium speciosum—Japanese Lily; white overland with pink, red dots; plant in fall under 6 in. of earth, in pocket of sand; 2 ft. to 4 ft. high.

Blooming in August and September

Lilium Speciosum, rubrum—Lily; pinkish, red dots; plant in fall under 6 in. of earth in sand pocket; 2 ft. to 3 ft. high.

Blooming in September

Colchicum autumnale—Meadow Saffron, autumn crocus; various; plant early in September in deep, sandy loam, under 2 in. to 3 in. of earth; will do well in part shade but likes full sun; naturalize only where grass is not too thick nor frequently mowed; 3 in. to 4 in. high.

Colchicum Parkinsoni—Autumn Crocus; white, checked, purple; plant in fall, same as above; 4 in. high.

Vegetable Gardens

NO home is complete without a garden for the growing of vegetables and fruits, and the average person takes as much pride in caring for his garden, as he does in beautifying his lawn and other home surroundings. It is impossible to give detailed directions for the culture of these crops which would apply to all of our varied conditions, but general hints on the growing of the common vegetables and fruits will be of use to the amateur gardener.

The first essential to a good garden is a carefully prepared soil. We cannot always choose the most desirable type of soil for the garden, but we can usually improve the condition of our soils by proper culture methods. One of the best and quickest methods of improving the condition of the soil is by the addition of fertilizer. To get the best results, the fertilizer should not merely be spread on the surface of the soil and plowed or spaded under, but should be well mixed with the particles of soil by careful cultivation with a harrow or a hand rake.

Plowing or spading should never be done when the soil is wet enough to be sticky. Dig up a handful of soil and squeeze it in the hand; if it is moist enough to form a ball of earth which will break into fine particles when dropped, it is in good condition to work. Plowing or spading should be deep and followed by harrowing or raking, as soon as possible. It is much better to turn over a furrow six inches wide, three inches thick and ten inches deep than one six inches wide, six inches deep and six inches thick, with a spade. Most amateur gardeners make the mistake of spading shallow and then raking only the surface of the soil. The particles of soil should be as fine near the bottom of the furrow as on the surface.

In planting, use only fresh seeds. It never pays to save unused seeds from year to year. The time to plant the vegetable garden will depend upon the locality and the particular kinds of vegetables. In general, most of our vegetables could be put into one of two classes, hardy and tender.

The hardy kinds would include such vegetables as radish, parsnip, beet, carrot, onion, peas, lettuce, spinach, parsley and potato. Cabbage and cauliflower would also be included in this list. These crops can usually be planted as early in the spring as the soil can be worked and in many localities, some of them may be planted in the fall. It is quite a common practice among market gardeners in Western Washington to plant onions, peas and cabbage in the late fall for early spring markets.

Such vegetables as pumpkins, squash, sweet corn, beans, pepper, egg plant and tomato, would be classed as tender kind. It is not wise to plant these crops until there is very little danger from spring frosts.

There was a time when gardeners thought it necessary that cabbage, cauliflower, tomato, egg plant, pepper and like plants should be seeded in a warm room or under glass six or eight weeks before time to seed in the field, and when they had formed a good root system and a stocky little plant with from two to four leaves, they should be set in the garden, but equally good results are obtained by sowing the seed in the ground, and we do not all

have a place convenient for sowing seed to be transplanted. The amateur gardener can usually obtain what early plants he desires at a local store.

When the young seedlings are well up, they should be thinned so that no two plants will touch. When transplanting, it is best to choose a cool, cloudy day for the work or at least late in the afternoon. The tender seedling will then be able to recuperate somewhat before being exposed to the hot sun.

Small fruits and often tree fruits are as desirable in the back yard garden as vegetables.

The soil for fruits should be as well prepared as for vegetable crops. The time for planting will depend upon the locality. In a mild climate, planting can be done either in fall or spring. In some localities, spring planting is more desirable.

Strawberries, gooseberries and currants should have a place in the garden. Where plenty of room is available, the cane fruits, such as raspberries and blackberries or some of the tree fruits, may be planted.

Although the time of planting and distances of setting the plants may vary somewhat in different localities, the methods of planting are practically the same in all.

Strawberries should be planted in rows from thirty to thirty-six inches apart, with a space of from twelve to eighteen inches between each individual plant. This is what is commonly known as the hill system. When setting the plants, the uneven roots should be trimmed back, leaving a rounded, well developed root. Prune back the top also, leaving only the growing point of the plant and the next youngest leaf. Strawberry plants should be set just at the crow or point of meeting of the roots and top. Do not allow runners to form with this system of growing strawberries.

Currants and gooseberries for the garden may be planted in rows four feet apart and the same distance between plants in rows.

Table for Planting Vegetables

The following planting table will be helpful to you in placing your garden, no matter what size.

Vegetables (Hardy)	Depth to plant	Distance of rows apart	Seed required for 50' row	Distance of thin plants	Ready for use
Beet	½" to 1"	12" to 15"	½ oz.	1" to 1½"	20-40 days
Carrot	½"	18" to 20"	½ oz.	3" to 4"	75-110 "
Lettuce	½"	12" to 15"	¼ oz.	4" to 6"	60- 90 "
Onion (seed)	½"	12" to 18"	½ oz.	3" to 4"	130-150 "
Onion (sets)	1" to 1½"	12" to 18"	1 pt.	3" to 4"	90-120 "
Parsley	½"	12" to 18"	¼ oz.	4" to 6"	90-120 "
Parsnips	½"	18" to 20"	¼ oz.	3" to 4"	125-160 "
Peas	2" to 3"	24" to 30"	1 pt.	¾" apart	40- 80 "
Potato	3" to 5"	24" to 36"	2½ to 3 lbs.	in hills 14"-18" apart in rows	80-140 "
Radish	½" to 1"	12" to 15"	½ oz.	1" to 1½"	20- 40 "
Spinach	1"	12" to 18"	¼ oz.	4" to 6"	30- 60 "
Turnip	½"	18" to 24"	¼ oz.	3" to 4"	60- 80 "

Cabbage and Cauliflower should be set in rows 24 to 30 inches apart and plants 15 to 18 inches apart in the row.

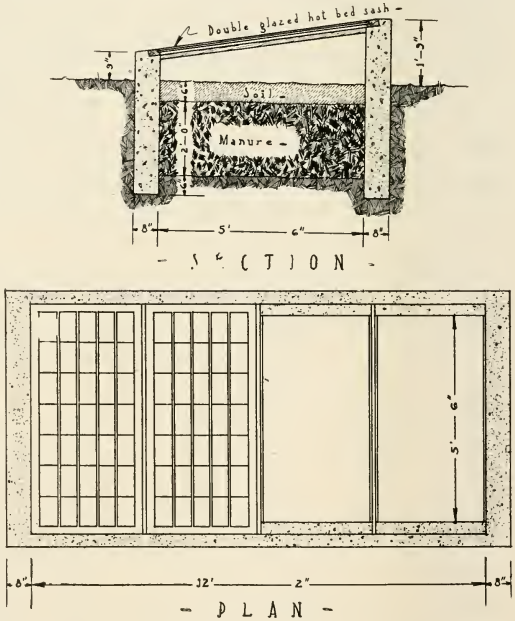
Vegetables (Tender)	Depth to plant	Distance of rows apart	Seed required for 50' row	Distance to thin plants	Ready for use
Beans (Bush)	2"	18" to 24"	½ pt.	2" in row	40-55 days
Beans (pole)	2"	3' to 4'	¼ pt.	3' to 4' in row	50- 80 "
Cucumber	1" to 2"	3' to 4'	¼ oz.	3' to 4'	60- 80 "
Muskmelon	1" to 2"	3' to 4'	½ oz.	3' to 4'	120-150 "
Pumpkin	1" to 2"	6' to 8'	½ oz.	6' to 8'	100-140 "
Squash	1" to 2"	6' to 8'	½ oz.	6' to 8'	100-140 "
Sweet Corn	2"	30" to 36"	⅛ pt.	30" to 36"	60-100 "

Tomatoes may be set 30 to 36 inches each way.

Making a Hotbed

THE hotbed consists of the sub-frame of wood, brick, stone, concrete or some other material admitted into the ground to retain heat. This is filled with fresh fermenting stable manure. On top of this manure is a layer of soil in which the seedlings are ground. The sash which are the essentials of the whole affair rest on the frame and have a slope of about 15 degrees to the south. It would scarcely pay a beginner to attempt to make the sash, as they can be bought for about twenty-five cents per square foot from sash mills.

Very often the terms "Hotbed" and "Coldframes" are used interchangeably and considerable confusion results. More often in practice the two types actually merge into each other. They are both miniature greenhouses where artificial conditions of temperature are maintained. The essential difference between the two is this: the hotbed is warmed artificially by means of heat generated from fermenting manure, while the coldframe derives its heat solely from the sunlight. The manure plays no part in the fertility of the bed and very often in place of the manure brewer's grains or some other material is used. The heat and fumes from the fermentation would gradually kill the tender rootlets of long seedlings if they came in contact with it. Therefore, in a hotbed the fermenting manure is used solely as a source of heat and not for fertilizing.



Construction of Hotbed.

The cold frame is warmed merely by utilizing the principle that if the sun's rays pass thru glass into an enclosed place, the temperature is raised. Hotbeds are sometimes warmed by other means such as coils of steam or hot water pipes.

In selecting the site for your hotbed you must remember that if properly built it is there to stay and cannot easily be moved. Besides being sheltered at the north, the southern exposure must not be shaded by trees or buildings. It may be placed where it will not interfere with

plowing or cultivation of your garden, and for the appearance of your place, a rather inconspicuous site is preferable. A good size for hotbed sash is three to six feet. Your frame will therefore be six feet in width and some multiple of three feet in length. A very good working standard consists of four sash which means a frame 6x12 feet.

In the actual construction of the hotbed a pit should be dug about four feet deep and a foot or more larger than the dimensions of the frame itself. After the pit is dug and drainage provided, the next step will be the sub-frame.

It is not advisable to use plank if you want a permanent bed. If you do not care to go to the expense of making a masonry frame, use 2 in. planks of some lasting wood such as chestnut, cypress or white pine. The life of the planks will be greatly increased if an application of coal tar or asphalt is applied before being embedded into the ground. The sash should be given a slope of about 5 in. from the back of the frame to the front. This will shed the water and catch the maximum of sunlight. The sash should be painted in order to preserve them. They should not be hinged to the frame, but merely rest on parting strips and stay in place because of their own weight. After the frame has been completed secure a heap of fresh stable manure, securing sufficient quantity at one time so that the preliminary fermentation can be done in a uniform manner. The fresh manure is piled in a heap and mixed with half its bulk of dry leaves. Those from hard wood trees are the best.

The manure must have a slow, moist-enduring heat. You will need about 2 cubic yards for each sash of the standard size. This may seem to be an excessive amount but you must not lose sight of the fact that in beds the manure is packed in very solidly. After the heap has fermented for a day or two it should thoroughly be forked over to cool it down. During a fermentation the temperature will sometimes rise to 110 degrees. A degree of heat, of course, would be fatal to growing plants. After forking, a second fermentation will take place and then after two days more the manure is ready to be placed in the pit of our hotbed. This pit should be filled within 18 in. of the sash frames. The manure must then be packed down solidly, special care being devoted to the sides and corners. Then put the sash in the frames and take the temperature of the hotbed, and when it cools down to 90 degrees Fahrenheit, the bed is ready for the top dressing of soil in which to plant the seeds. On the outside of the bed a bank should be piled against the frame, using soil or coal ashes. This will help to retain the heat and to exclude the cold.

The top dressing should be from 6 to 10 in. deep. The ideal soil is somewhat sandy which will prevent baking and will remain pliable and crumbly. A mixture of green mold sand and well rotted manure will accomplish this result. Some gardeners do not plant the seed entirely into the hotbed soil, but use shell boxes, technically called flats. This is very satisfactory but not absolutely necessary. Hotbeds and coldframes will require some protection at night to retain the heat. During the day a certain amount of heat is contributed to the hotbed by the sun, but at sun-down the temperature invariably falls and to retain a temperature of, say, 60 degrees in the hotbed when it is below freezing outside, we must give some protection other than that furnished by the glass. This can be done by using double sash, old carpets, matting, blankets, burlap bags or even straw which are simple expedients. The best plan, tho, is to make a permanent mat fitting over the top of your frame. This can be rolled back each morning with very little trouble.

Part III

Contains Instructions for the Erection of Building Proper

Introduction to General Instructions

THE purpose of these instructions, which are furnished with all Aladdin buildings, is to help purchasers and builders of our houses, eliminate lost motion and also do away with many of the costly mistakes often made by carpenters. We have pointed out a large number of labor saving steps which will save many dollars for our customers.

These instructions, together with blue prints, should be carefully read over by the men in charge of the operation, so that they may become familiar with our methods of erection, and do away with the "studying out" which generally takes place on building operations.

In this manner any little step which is not thoroughly understood can be taken up with our Construction Department, from which any information will be furnished immediately. These instructions in some instances may sound amateurish, but they have been furnished for general use among all classes of builders from the so called "Wood Butcher" to the mechanic in carpentry.

You will notice on blue prints, notes referring you to different pages in the Aladdin Manual of Construction. It is necessary for you to study thru only such paragraphs as are referred to by these notes. The general construction is the same in most cases, but you will appreciate that instructions have to be furnished for many kinds of roofs and porches and houses of different designs. The kinds of porches and roofs you will notice are marked with Style A or Style B, so that one may be distinguished from the other. In addition to having them indicated by a style letter, we also have placed a note on blue prints to refer to a certain page in this book. On the first sheet of the blue prints you will find the different steps of erection to be followed and the page or paragraph to refer to, to find out just how to go about it in order to obtain the best results.

Any step in erection which our customers have been able to handle in a quicker and better method than stated herein, will be appreciated if sent to our Superintendent of Construction.

Par. 1—Unloading and Caring for Material

Immediately after the car of material has been secured from the Railroad Company, inspection should be made to see that the seals have not been broken and if any material has been damaged in transit. If seals have been broken, this should be reported to the railroad agent at once. If any material has been damaged in transit, claim should be filed with Railroad Company so that you may be able to secure reimbursement for same.

The material should all be checked while it is being unloaded from the car (not after it has been drawn to building site). Claim should then be filed immediately so that we can replace any shortage which may occur. We cannot be responsible for material after it has left car. If it is necessary to have material in car over night after it has been received from Railroad Company, a lock should be placed on the doors.

A loading copy of material contained in car is furnished and should be used in checking the material out of the car. The same should then be forwarded to Aladdin Co. immediately after car has been unloaded, and should contain notation of any material you have found damaged, or any material that checks short in your shipment. Often material has been lost or stolen after it has been placed on building site. We will not reimburse any claim of this nature.

To insure quick erection and to keep material in good shape, the following instructions should be carried out: Many of our customers have made the grievous mistake of unloading all material in one big pile, taking no pains to sort out different kinds and lengths of material, leaving finish material, hardware, mill work, etc., exposed to the elements of the weather, very much to their sorrow.

All the material should be carefully piled and sorted while it is being drawn to building site. All the 2x4's should be sorted out from the rest of the material, and they in turn sorted according to the lengths which have been marked on each piece, that is, all 16 ft. 2x4's in one pile and 3 ft. in another, etc. Then when you see that blue prints call for a 2x4 16 ft. long, you do not have to go thru a whole carload of material to find it. All the sheathing, rafters, etc., should be sorted in same manner. By referring to Fig. 144 you will notice that this material has been carefully sorted and placed in convenient piles.

All the hardware and finish, such as flooring, windows, doors, etc., should be placed under cover, as all this material has been thoroughly kiln dried before shipment. If you have no barn or shed in which to place this material,

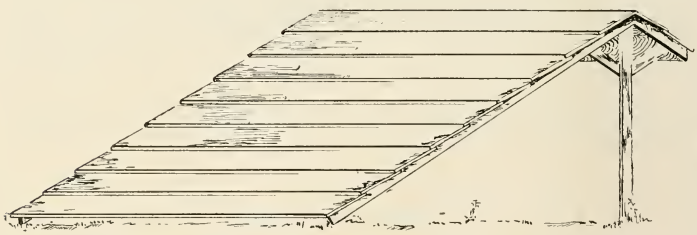


Fig. 144—Construction of temporary shed to cover material.

a rough shed can be constructed in a few minutes as shown by Fig. 144, which will only have to be used until your roof has been shingled over. A shed can be constructed in this manner 16 ft. long and 10 ft. deep for about $6 or $7.

Kiln dried stock, however, after being exposed to the air a short time, will absorb a certain amount of moisture from the air itself. We earnestly advise, therefore, if it is possible for you to do so, to put your finishing lumber and flooring in a hot room for several days before it is to be used, so that as much of the moisture as possible which has accumulated from the air, will be taken out of the material. This will insure joints in flooring and finish from opening up after job is complete.

Par. 2—Special Note Regarding Change on Blue Prints

To avoid trouble in erecting your Aladdin house, follow these rules absolutely:

Do not cut material intended for one place and use it in that of another.

Do not change plans. If you do, you cannot expect material to fit and work out as intended.

All work is carefully laid out on blue prints, and explained by these instructions, and is so simple that many women have erected Aladdin houses without male assistance, and as one of them remarked: "Any man should be ashamed to admit having any difficulty in erecting an Aladdin house, so simple are the blue prints, and all he has to do is to follow instructions. Good sense is the main requirement."

Do not take anyone's advice as to how your building should be erected. We have found upon investigation that this causes more difficulty in the erection of our buildings than all the other things put together. Erect your buildings only as provided for on blue prints and instructions and you will encounter no difficulty.

Every piece and kind of material for your complete building is carefully checked and loaded into your car. You cannot expect this company to replace any material which has been lost or stolen after shipment has been accepted from Railroad company. Take care of everything, as some one may need a bundle of shingles or a roll or roofing and will not bother to buy it.

Do not leave blue prints exposed to sun, as this acts on the chemical surface of paper and reduces the strength of the blue surface. Keep them carefully rolled up when not in use, and at night they should be placed in tool box or some safe place.

Fig. 144A—Shows material carefully placed in convenient pile near foundation.

No scaffolding material has been furnished with this shipment; only the material for the building itself has been furnished, except a few pieces of each kind of material which have been marked "Extra" are included. These are the only pieces which can be cut up to be used in building in case of a necessity.

With each set of blue prints we furnish an itemized list of material, divided up according to the figure numbers shown on blue prints. It shows the different lengths of material which are to be used with each figure. In erecting each figure on blue prints refer to this itemized list of material and use only such pieces in this figure as are contained on list under the figure number. For example, you will find all the studding for the outside walls listed under the different figure numbers which will correspond to those shown on blue prints. Under no circumstances make any change in the erection of your building, for only such items as are listed on bill of material are furnished.

Explanation of Blue Print Measurements

As stated previously, it is very important, before starting the erection of your building, to separate all the different kinds of material into separate piles. It is also important that you separate each different length of material into distinct piles. This will enable you to find every piece as fast as you require it in the erection of your building.

The different lengths of material have all been marked, and only such material as might possibly be confused with other kinds is furnished, marked with figure number or place in which it is to be used, or name stamped upon same. For example: the porch floor is marked "Porch Floor," flooring for first floor, "First Floor Flooring," and flooring for second floor. "Special Floor Flooring." All mitered material is carefully bundled and marked to indicate the exact place in which it is to be used.

On the blue prints, you will notice the measurements given between the joists, studding and rafters have the fraction ¼, ⅛, ⅜ or ½ added to the measurement. The purpose of adding on this fraction of an inch is that two inch material when dressed, usually dresses to the thickness of 1¾ inches. In giving the distance between two pieces of 2x4 placed on 16 inch centers, that is, 16 inches from one piece to center of the other, we have added ¼ of an inch for the reason that in reality 2 inch material is only 1¾ inches. Therefore, when making your measurements, it is a good policy to measure from center to center of each stud, joist or rafter. This will insure each piece coming exactly as it should.

Hardware

The term "Builder's Hardware," to-day, covers all metallic mechanical fitting used in building construction. The purpose of "Builder's Hardware" may be classed under three heads: Protection, Convenience and Decoration. Locks, latches, catches, bolts and hooks are used to hold temporarily some adjustable part of the construction in a fixed place, for a certain purpose, and to further the convenience of these members.

Many different patterns and designs of the different hardware parts have been invented, but all serve to accomplish the same purpose in construction.

In the following paragraphs we will explain and cover in detail all the different items of hardware furnished with Aladdin buildings. Each piece and kind is furnished for a certain purpose in the erection of your building and the following paragraphs should be studied carefully in order to secure the desired results.

An itemized hardware bill is furnished with each order, and should be used to check the hardware out of the boxes and different packages. On each package is placed a slip stating what is contained in it. Each hardware bill has been carefully compiled, and the material checked into container by a double check system. Everything necessary for your building should be shown on hardware list and everything on list should check out of car.

All the hardware should be placed under shelter to prevent it from becoming rusted and stained from damp or rainy weather.

Nails

Nails are made in great varieties for various purposes. As a general distinction they are called spikes when very large and brads if very small. When small with large heads, they, are called tacks. A staple is a double pointed nail.

To-day nails made from steel wire have almost superseded the use of cut and forged nails. They are made in a great number of kinds and sizes. The common varieties are known as 6 penny, 8 penny, 10 penny, etc., which meant at the time the name was given them, that 1,000 nails weighed five pounds, eight pounds, ten pounds, etc. Of late the sizes have been standardized in length, which makes the number in a pound somewhat different than formerly. The lengths are made to conform to the standard size of material, and to fit into the different places for which they are intended.

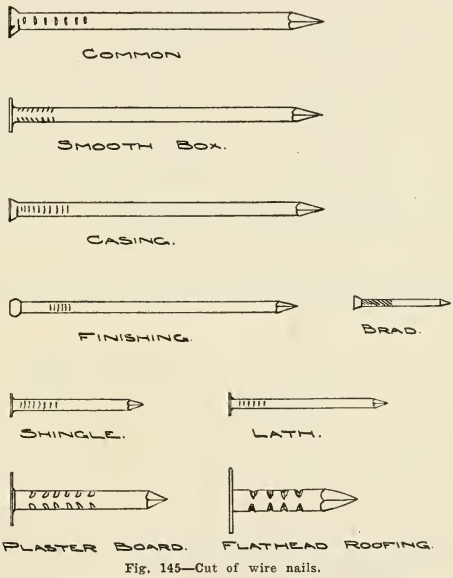


Fig. 145—Cut of wire nails.

Standard lengths of nails:

Sizes ..	2d	3d	4d	5d	6d	7d	8d	9d	10d	12d	16d	20d	30d	40d	50d
Length	1″	1¼″	1½″	1¾″	2″	2¼″	2½″	2¾″	3″	3¼″	3½″	4″	4½″	5″	6″

All the kinds given in the tables are put up 100 pounds to a keg. Coated nails are from 70 to 80 pounds per keg.

Number of nails per pound:

	2d	3d	5d	6d	8d	10d	12d	16d	20d	30d	40d	50d	Plaster board	1¼" brads
Common	664	685	252	204	93	78	60	48	31	16	12	10	212	.....
Finishing	.....	.....	.....	300	168	140	.....	.....	.....	.....	.....	.....	.....	.....
Casing...	.....	.....	340	210	130	88	80	62	45	40	35	.....	.....	706

All the nails which have been furnished for your building are for a certain purpose, and the following table should be used.

Do not leave your nails out over night, for if it should rain they will become rusty and hard to handle.

Kind of Nails	To be used for
2d common	Shingles
3d common	Lathing
5d common	Siding
8d common	1 in. Sheathing material
16d common	2 in. material
20d common	Timbers
8 casing	Flooring, door and window, frame, trim
6 finishing	Ceiling, door and window frames, interior trim
1¼ in. brads	Window frames
Plaster Board nails	Plaster Board
Roofing nails	Roofing

The number of different nails furnished for each kind of material is as follows, and if the nails are not wasted and used as directed, there should be enough of all kinds:

2¼ lbs. of 2d galvanized for each 1000 shingles.
6 lbs. of 3d fine for each 1000 32 in. lath.
15 lbs. 5d common for each 1000 bd. ft. 5½ in. bevel siding.
12 lbs. 5d common for each 1000 bd. ft. 6 in. T. & G. siding.
15 lbs. 5d common for each 1000 bd. ft. 3½ in. bevel siding.
35 lbs. 8d common for each 1000 bd. ft. 1 in. sheathing.
15 lbs. 16d common for each 1000 bd. ft. 2 in. material.
15 lbs. 8 case common for each 1000 bd. ft. flooring.
15 lbs. 8 case common for each 1000 bd. ft. outside finish.
10 lbs. 6 finishing for each 1000 bd. ft. ceiling.
10 lbs. large headed nails for each 1000 sq. ft. plaster board.
1 lb. large headed nails for each carton semi-slate shingles.

Additional 6 finishing and 8 case are furnished for interior trim, window and door frames. By referring to the table giving the number of nails in a pound you will find for example:

252—5d nails in a pound. Now on 5½ in. bevel siding we furnish 12 lbs. per 1000 bd. ft. or 2000 lineal ft.

3024 nails in 12 lbs.; 2000 lineal ft. siding.

2000÷3024 equals .66.

This will allow you to have a nail about every 8 in., which is not necessary, but just serves as an example to explain if the nails are carefully used there will be a great sufficiency.

Building Paper

White fibre building paper has been furnished to go between the siding of the outside walls and the sheathing, and between the finished floor and sub-flooring. The paper should be placed on horizontally over the sheathing, letting one layer overlap the preceding one about two inches. Bring the paper down tight to the sheathing; a few lath can be used to hold same in place until the siding has been put on. Place the lath or small strip of wood over the paper in such a manner that they will serve as a guide to nailing the siding directly over the studs, as much as possible. When placing the pieces of wood on paper to hold it, they should be placed alternately so that one piece is placed on top and the next near the bottom of layer of paper. Then after the siding has been laid onto the bottom of the roll, the lower pieces can be moved and it will be held firmly in place by the remaining pieces at the top.

Carefully strip around all the window and door frames when they are being set in place, letting the strip of paper extend out far enough to form a good lap with layer under the siding.

On buildings that have the side walls covered with stucco, tar paper should be placed over the side walls instead of white fibre, to insure against damp walls.

No more paper should be put on in one day than can be covered with siding or flooring, as the wind will tear it off very easily. Caution should also be taken to keep paper dry. If the siding or flooring is placed on over wet or damp paper it will take up moisture from the paper and is very apt to warp.

Building paper comes in rolls of 400 square feet each and will weigh about 30 pounds per roll.

Window Hardware

Check rail windows: Many fasteners have been manufactured and patented to operate check rail windows with more or less success. The two methods most commonly used, and, no doubt, the most practical for check rail sash are the spring window bolts and weights and pulleys. On the smaller and cheaper houses, the spring window bolt is used with satisfactory results. It is simply constructed and easily applied. Fig. 146 shows a type of sash spring bolt which is placed in the center of the side rails of the sash, extending out from the side of sash about one-half inch. Small holes about the same size in diameter as the end of the bolt are then bored into the side style of the window frame to receive the projection of the spring bolt. When the sash is to be lowered or raised, the small handles on the inside of the sash are drawn so as to bring the opposite end of the bolt flush with the sash, permitting it to be moved in the desired direction. In placing the holes in the side style of the window frame, be sure to have them centered directly opposite each other so that the sash will hang evenly. The holes bored into the sash should be just large enough so that the bolt will fit into them tightly. The spring bolts should be centered in the O. G. part of sash or in the center of that part of sash from

Fig. 146—Spring Window Bolt.

the inside of glass to the inside of sash. It should also be centered between top and bottom rails. The proper application of the hardware to the window is very important to the successful operation of same.

Windows, unless carefully made and fitted, are apt to be a very weak point in the building. Sash which are not properly hung will bind and sag, and will cause considerable trouble. When sash are equipped with weights, they should be well fitted to start with and properly balanced with weights, operating over sash pulleys. Fig. 147 shows a sash pulley of ordinary type. The face of the pulley housing is set in flush with the face of the pulley style, thus setting the bearing center of the pulley wheel back into the weight box. In order that the weight may hang properly the diameter should be so that it will allow the weight to hang in a position so it will not be scraping against the sides of the weight box, and also prevent the continual bending of the sash cord over an arch of small radius which is injurious to cord. Care should be taken that the pulleys are smooth on all surfaces where the cord touches and that they are fit properly in housings. It requires two pulleys to each sash.

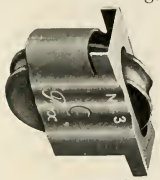


Fig. 147—Sash Pulley.

Braided cotton sash cord is strong enough for all light windows, chains only being necessary on large plate glass construction. The sash cord should be securely fastened to the weight and also to the side of sash which has been plowed to receive same. It should be cut the proper length so that when lower sash is raised the weight will not strike sill, and when upper sash is lowered it will not strike the pulley in side style. The amount of cord required for a window will depend upon its height. It takes four pieces the length of the window to equip it, allowing a little extra to run into the side of sash where it has been plowed out, and also enough to knot on weight. The cord should not be left projecting out of the grooved part of sash at top, as this will cause the sash to bind.

Window weights are usually made of cast iron and weigh from two to twenty pounds each, and from 1½ in. to 2 in. in diameter, and from 5 in. to 25 in. in length. Lead weights are often used where a heavy weight is required in a small space. It requires four weights to each window. The following table gives the size of weights required for the different size sash furnished with Aladdin houses.

Glass measurement	Weight
12 x 16	2½
14 x 20	3
14 x 28	4
20 x 28	5
26 x 16	4
26 x 24	5
26 x 28	6
30 x 20	5½
30 x 28	7
30 x 36	9
38 x 20	7
38 x 28	9
38 x 36	11

If the sash are divided into small lights, add one pound to each weight. Securely fasten the weight to the lower end of the sash cord so the weight will hang as near the center of the pocket as possible.

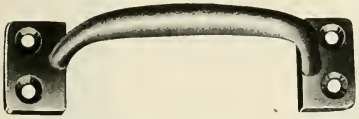


Fig. 148—Bar Sash Lift.

Fig. 149—Flush Sash Lift.

Sash Lift: If the sash are properly balanced, no great effort is necessary to raise or lower same, yet some device which can be gripped easily is desired. There are three types of sash lifts commonly in use. Fig. 148 shows small bar lift; Fig. 149 shows a flush sash lift and Fig. 150 shows a hook lift. These fixtures are fastened to the center of the lower rail of the bottom sash and are held in place by small screws.

Fig. 150—Hook Sash Lift.

They should be used at all times and are a protection to your sash, as they help keep your sash from becoming finger marked, and also when the sash is forced open by pushing up on the check rail or down on the lower rail, you are very apt to spring the rails and putty away from the glass and the putty will eventually drop out and the glass will rattle in the sash. If it is necessary to push on the sash to raise or lower them, be sure to apply the force at the corner, not in the center.

Fig. 151—Sash Lock.

Sash fasteners are for the purpose of fastening the sash for protection and to draw the check rails of the upper and lower sash tightly together. Fig. 151 shows the type of sash fasteners furnished with Aladdin houses which are generally considered as good as any manufactured. It fulfills the requirements of drawing the two sash together, to prevent rattling, and leakage of air. When properly screwed in place they will hold sash securely together. The cam action of these fasteners also brings the top sash tightly up against the head style of frame and the lower sash down to the sill. They should be placed in the center of the check rails of upper and lower sash.

Casement Window Hardware

Casement sash are equipped and are adjustable upon a pair of butts. Most casement sash are hinged at the side and swing in. Fig. 152 shows a $2\frac{1}{2}$x$2\frac{1}{2}$ in. loose pin butt commonly used on casement sash. The opposite side is equipped with a small fixture called casement fastener, which is placed in the center of sash to lock sash when closed. The fastener is placed on

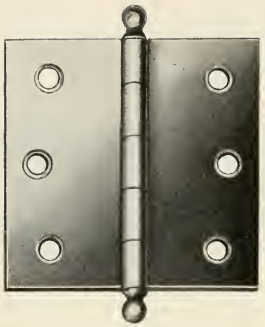


Fig. 152—Casement Butt.

the inside surface of the side rail of sash and the strike is fastened to the side of the window jamb. The butts should be placed so that when the sash are closed they will swing completely into the frame and fit tightly. When the casement sash are made in pairs, the sash are hung on butts in the same manner but the fastener is placed on the side rail of the right sash and the strike on the

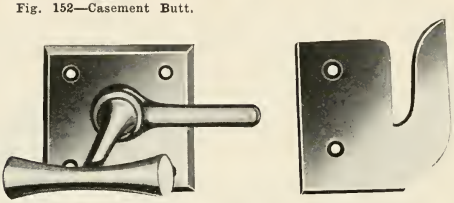


Fig. 153—Casement Sash Lock.

Fig. 154 Casement Flush Bolt.

side rail of the left sash. The sash on the left side is also equipped with a pair of flush bolts, one for the top and the other for the bottom.

The sash are housed out so that the bolts will set flush and the small strikes are placed one on the head jamb and the other on the sill so as to receive the projecting rod of flush bolt. Fig. 153 shows a casement fastener and its strike, while Fig. 154 shows a casement flush bolt.

Transom Sash

Transom sash are equipped with a pair of butts, which hold the sash in place at the bottom or top, whichever the case may be. The sash are connected with a rod held in place by brackets. This rod can be lowered or raised and holds the sash in the desired position. The lower bracket of the rod is equipped with a catch which holds it any fixed position, when the sliding rod is passed thru it. This clamp or catch in the lower bracket will hold the sash securely in place when closed. Fig. 155 shows the construction of the transom rod and brackets. The brackets of the rod are fastened to the side casing of the door or window frames and the end bracket to the inside of the sash. In raising or lowering the sash, always push the thumb clamp together so the spring will not lose its tension and destroy its power to hold transom rod firmly.

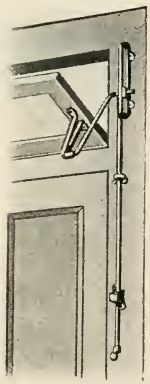


Fig. 155 — Recessed Transom. Bottom hung. Opening in.

Cellar Window Set

For cellar sash which are generally hinged at the top we furnish a pair of 2x2 in. black Japan butts to fasten the sash to the frame. The windows should swing inward, and in the set is included a hook and eye to hold the sash to the floor joist when it is open. A button is furnished to lock the sash when closed and should be placed in the center of the bottom sill of frame so that it will turn up and on sash. Fig. 156 shows a cellar window set. These pieces of hardware are all packed in a small box and marked "Cellar Window Set."

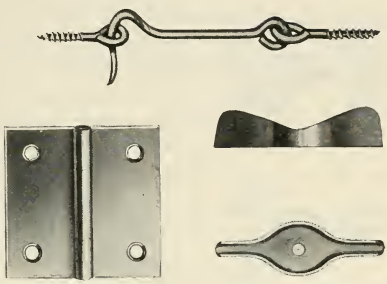


Fig. 156—Cellar Window Set.

Hardware For Roller Slat Blinds

The hardware set for roller slat blinds is shown by Fig. 157 and consists of a pair of special hinges and a special catch for each blind. The hinges are constructed so that when the sash are opened the special catch automatically catches and holds the blind back against the side of house. Then when you want to close same, the blinds have to be lifted out of their catches on the hinges.

The fasteners consist of an arm and a bracket which hold the blinds securely in place when closed.

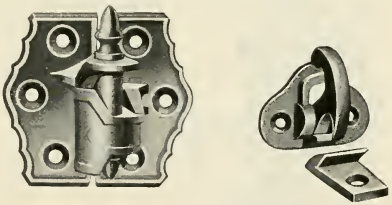


Fig. 157.

The gravity hinges are fastened to the face and side of the blind and to the side casing of the window frame, so when closed they will set flush with the casings.

Storm Sash Hardware

Storm sash set consists of two hangers and an adjustable bracket and arm. The two hangers are fastened to the head casing of the window frame and to the top style of the storm sash. The arm adjuster is fastened to the sash near the bottom and the small bracket thru which the arm slides is fastened to the side of the window frame. To open up the sash this arm is let down and passed thru bracket and catches in little slat at the end. When the sash is closed the arm is raised up alongside of frame so that it will not interfere with window sash, and also hold the sash securely in place. Storm sash should fit between and set flush with the outside casings of window frame.

Pivot Sash Hardware

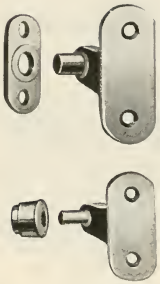


Fig. 159—Sash Center.

Pivot sash or sash that are fastened in the center of the side rail or in the center of the top and bottom rails are furnished with fixtures which act as a pivoted center upon which the sash can swing to open or close. Fig. 159 shows two common forms of sash centers. One part of the fixture is attached to sash and the other to the side jambs of frame. Fig. 160 shows a fastener which holds sash in place when it is closed.

A more simple way to equip pivot sash is to place two spring window bolts on the rails of the sash instead of the sash center and then bore small holes in the jambs of the window frame to admit the end of the bolts.

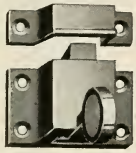


Fig. 160—Pivot Sash Fastener.

Hardware Equipment of Doors

Mortised Locks and Knobs: A mortised lock consists of the following parts: Two knobs, one for each side of the door, these two knobs are connected with a spindle which in turn connects the knobs with the latch or lock. The spindle is usually made in the shape of a bar, and has two small holes tapped near each end for the insertion of a screen from the shank of each knob. Small washers are furnished on the bar to make up for any inequality of spacing.

Fig. 161—Cylinder Door Lockset.

Fig. 162—Front Door Lockset.

On each side of the door are placed plates called escutcheons which have a small screen hole at the top and bottom and a hole for spindle to pass thru and one for the key hole, depending on the construction of the lock. Some lock sets are constructed with small key escutcheons. When locks are equipped with these small key plates, the spindle is finished with a rose where it passes thru the door.

The lock itself is placed in the mortise of the door so the plate is flush with the edge. Mortised locks are constructed so that the plate can be removed and the latch turned up side down and can be used on door swinging right or left hand.

The small strike is placed on the side jamb of the frame to receive the projection of the latch and projecting bolt of the lock.

It is a good plan to hang door on the butts and leave the lock set off until after the door has been painted or varnished. Then if it has to be refitted the lock will not be in the way. and if it is attached while painting or varnishing is being done, it will be smeared up to some extent.

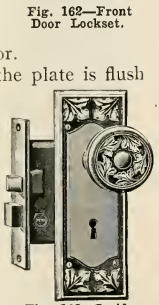


Fig. 163—Inside Lookset.

Butts

On doors which are 3x7 ft. and one in size, or those which are extra heavy on account of extra glass, we furnish 4x4 in. butts. On all other doors, 3½x3½ in. butts are furnished. The side jamb of the frame and swinging edge of the door should be housed out enough to admit top of butt to come flush.

These butts are constructed with a loose pin and the door can be removed very easily if necessary, without taking off the hinge.

Sliding Door Lock Sets

Sliding doors or doors which slide on tracks and rollers into recesses between the partitions are fitted with hardware as shown by Fig. 164, which consists of two separate locks which are placed into the mortise of the door. One side has a key attachment to lock the doors. The other side has a hole in plate to take projecting bolt of lock. Both sides of lock are fitted with small handles to use in bringing the doors together.

These handles or disappearing pulls are controlled by small push buttons at the bottom of the plates.

Two pair of escutcheons are furnished with each sliding door set. One pair with key recess and one pair without.

When sliding door set is furnished for single sliding doors, the set consists of two escutcheons and a strike similar to those furnished with a swinging door which are furnished to go on side jamb of frame to take the lock bolt.

Fig. 164—Sliding Door Lockset.

Track and hanger of sliding door is shown by detail of Fig. 165. Care should be exercised to see that track is set and doors hung so these will not bind in recess of partition.

NOTE: That key can be adjusted to fit any size door by unscrewing set recess and pulling out bolt.

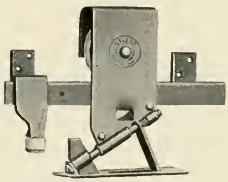


Fig. 165—Track and Hanger for Sliding Door.

Screen Door Set

This set consists of a small handle which is placed on the outside of door, a hook and eye which is to be placed on inside of door to lock same, the spring to close door and a pair of butts. Screen door should be hung so as to swing free of sill and fit together between outside casings of door frame. The thickness of the door should be the same as the outside casing.

Ball Bearing Surface Floor Hinge

The carpenters are not required to do any mortising in the door for the tongue of the hinge, which is a saving of work and time.

The attachment to the door is stronger than any other makes, as the screens in the tongue are about 8 inches from the back edge of the door, eliminating all chances of the door checking or splitting.

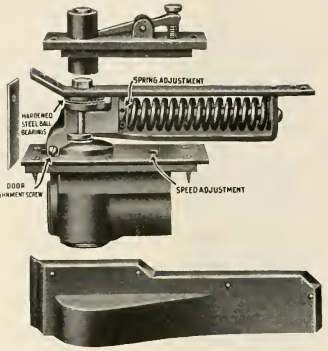


Fig. 166.

Fit the door to the size of the opening in width and ½ in. shorter than the height. Round the back edge to allow it to swing close to jambs of frame. In the bottom of the door and in the back edge, cut out a rectangular block 8⅜x1½ in. Mortise in the small attaching plate, flush, leaving the rounded end 1/16 in. from the back edge of the door. Enter the round headed stud on the top rib into the large hole in the attaching plate and push the hinge forward until the back end of top rib is flush with rounded end of the attaching plate, and fasten it to the door with two wood screws at the front end of top rib.

Apply the pivot at the top of the door; the part with the pin should be sunk flush in the head jamb. The distance from the side jamb to the center of the pin should be 1⅝ in. after the hinge is secured to the door. Set the door in place by entering the pivot at the top of door first, then flush the bottom in until the door is plumb; before securing the plate to the floor see that the door is in line with the jamb.

The spring tension can be regulated with the tension met at the end of spring.

Next apply the side plates to the surface of the door and flush with the bottom, letting the heel of the plates in flush with the back edge of the door, and fasten the small plate over the joint at the back.

For tile and cement or combination floors use expansion screws to fasten to floor.

Top and Bottom Bolts

On pair of swinging double doors a top and bottom bolt has been furnished to hold one door securely in place. Fig. 167 shows the different parts of the two bolts. The bolt with the chain attached is to be placed at the top of the door. The chain guide has been furnished so chain will not catch between the two doors when they are being closed. Two different styles of catches have been furnished with the top bolt. The round one to be used when the bolt comes flush with casing, and the flat catch is used when the bolt is placed on inside of door or toward the center of jamb.

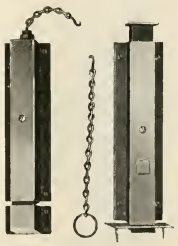


Fig. 167.

The other bolt is placed at bottom of door and the catch is let into the floor so that the top will come flush with top of floor.

Foundation, Pier and Built-up Sill or Sills

IT would be difficult to adopt a standard for foundations in this country to meet all requirements, as the conditions in the different parts of the country and the material available make this almost impossible. We have furnished detailed information on the construction of those most commonly in use. You will also find tables giving the amount of material necessary for concrete, brick and cement block foundations under the caption of the different materials. Of course the cost of material will vary in different parts of the country, but with the information given it ought to be an easy matter for you to figure out the material required and approximate cost.

All our houses are furnished and constructed to set on permanent foundations with walls, unless otherwise specified. The foundations can be constructed of whatever kind of material you prefer. Fig. 2 on the set of blue prints shows the foundation plan of the building with the exact outside dimensions of the walls. It also shows location and size of all porch and girder piers, the construction of built-up sill or sills, suggested location for chimneys and sectional views and construction of foundation walls.

The foundation should be constructed exactly as shown on blue prints. Care should be taken to see that the walls are perfectly level and square with each other; this is very essential in order to have material work out and fit as it is intended.

Most of the porch piers you will notice are to be constructed so as to give a fall to the porch joists in order that the water will run off the porch floor.

As stated before under the subject of foundations in Part I, if you find that the size of footings and walls given will not meet requirements of the building codes of the community in which the building is to be erected, they will have to be changed. Most

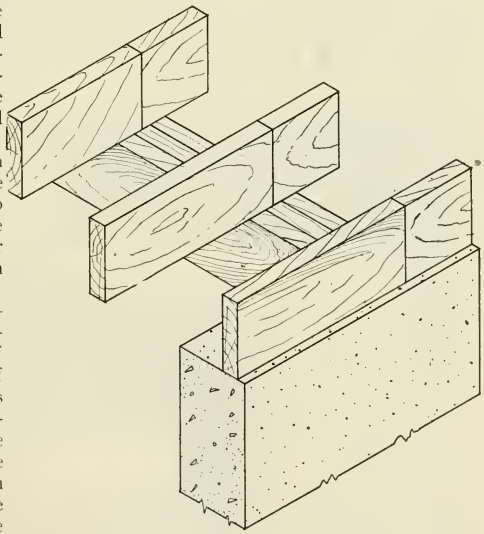


Fig. 168—Joist breaking on center of sill.

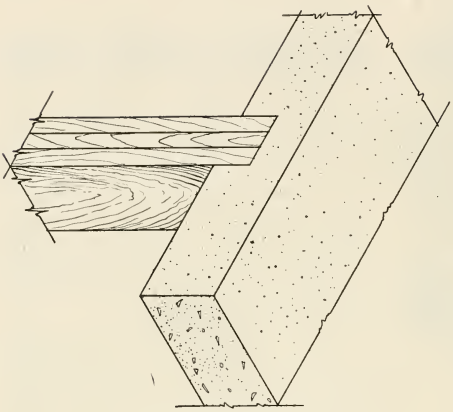


Fig. 169—Position of sill in foundation wall.

of the foundations are drawn with 8 in. walls and 16 in. footings on our prints; the thickness of the walls will not make any material difference in the construction of building, so long as the outside dimensions are kept the same. The walls can be made 10, 12 or 18 in. if required to meet local conditions and building codes.

Carefully study the construction of the foundation you wish to erect before starting, and you, no doubt, will be able to save considerable in time and cost.

The built-up sill or sills should be placed exactly as shown on blue prints, so that the break in the joists will come in the center of them. See Fig. 168, which shows break in joist resting on center sill. The foundation walls are also to be notched out so as to receive the ends of the sill, that is, the top of the sill will be level with the top of the foundation wall. Note Fig. 169.

The piers which support the sills will have to be constructed the depth of the sill below the top of the foundation walls—that is, if the sill is 6x8, the girder pier will be 8 in. below the top of walls.

The cellar windows can be placed in the walls where desired. It is the best plan to set frames while walls are under construction, so that they can be cemented firmly in place. If the frame cannot be obtained so they can be placed in walls while under construction, 2x2 inch blocks can be set in wall, and the frame nailed to these blocks. See Fig. 13. Cellar windows are not included in general specifications unless specified.

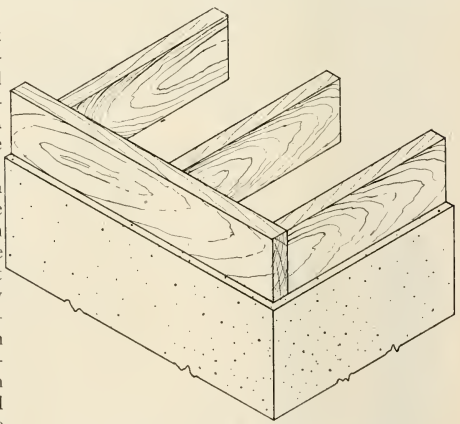


Fig. 170—Position of joist header on ends of joist.

The sizes on the foundation plan show the outside dimensions to be 2 in. larger than the frame of the building. This is done so that when the sheathing is put on, it will come flush with the foundation walls, and the water table which is placed over the sheathing will carry the water out over the foundation.

The foundation is a very important step in the erection, and if it is not properly constructed is apt to cause more trouble than any other part of the house. First, it is essential that the footings are constructed to carry weight of building, and withstand the bearing power of soil. (See "Footings.") Carefully study the soil, water and frost lines. Location and depth of sewer. Be sure you are going to have a dry basement. Read over all the different subjects under "Foundations."

Framing

Considerable time can be saved in the erection of your house, by the proper use of the steel square in laying out the location of joists, studding, rafters, etc.

The steel square consists of a blade which is 24 inches long and 2 inches wide, and the tongue which is from 14 to 18 inches long and 1½ inches wide. A square with the tongue 16 inches long can be used to the best advantage for the work described in this book.

When properly used, it requires but a very short time to lay out the location of the studs in a wall of the building. You will notice that the spacing of studs, joists, ceiling joists, etc., on the blue prints is as near 16 inches from center to center as possible. Sometimes it is necessary to drop back in order to take care of an opening in wall or joist. In spacing, use the tongue of the square and start from "in" to "out," meaning to space from the inside of one joist to the outside of the next.

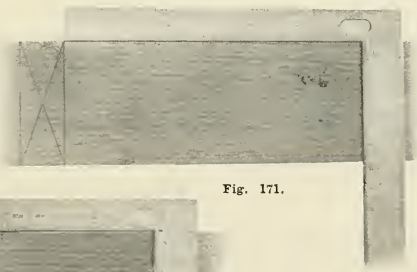


Fig. 171.

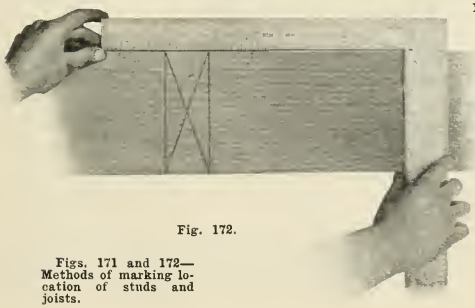


Fig. 172.

Figs. 171 and 172—Methods of marking location of studs and joists.

The square in position as shown by Fig. 171 will space studding or joists on 16 inch centers. If it is necessary to drop back in order to take care of studs or joists for sheathing to break on, simply move square over as shown by Fig. 172. When one becomes acquainted with its many uses in the erection of a building, the steel square is a much better and quicker way of marking location than the old method of using folding rulers. But one must remember that it is very easy to get spacings wrong and openings in walls and joists should be "proved up." In marking it is always a good plan to use a sharp pointed instrument and not a big, heavy pencil, as the width of a heavy pencil line added or taken from each spacing will throw you out considerably in the long run. A good method to use in proving your spacing is to have a measuring pole 4, 8 or 12 ft. long. Four feet is the equivalent of 3 16-in. spaces, eight feet to 6 16-in. spaces, and 12 ft. to 9 16-in. spaces. Lay the measuring pole on your plates when marked off and see if the four, eight or twelve ft. points come in the center of the third, sixth, or ninth 16-in. space.

It is also a good plan to make a couple pair of horses, which can be constructed very easily as shown by Fig. 172-a, and also a ladder as shown by Fig. 173, which will be very useful during the erection.

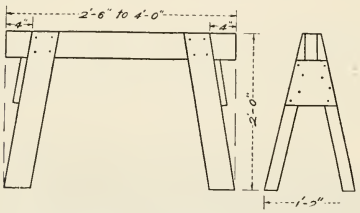


Fig. 172A—Here is a practical saw horse which can be easily made.

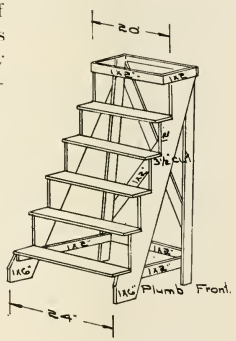


Fig. 173—
Handy Ladder

Laying Joists First Floor

Fig. 3 of the blue prints will show the construction and arrangement of the first floor joists as they are to be placed across the top of the foundation wall and built-up sill or sills. It also shows the arrangement of the sub-flooring over the joists with lengths alternated; the lengths of finish floor furnished; and the construction of the porch joists if porch is included. Note that the joists are to set in on foundation one inch. For example, on our Stanhope No. 2, the foundation is 24 ft. 2 in. x 36 ft. 2 in. and the joist frame is 24 ft. 0 in. x 36 ft. 0 in.

Pay no attention at this time to the porch joists. Instructions for the erection of the porch joists will be given later under the porch instructions. To lay the joists, space off on the joist headers the

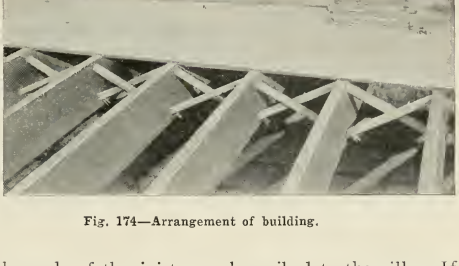


Fig. 174—Arrangement of building.

correct distance where the joists are to be placed, also mark these distances on the sill or sills. The joist headers are the pieces nailed on the end of the joists supporting them over the foundation walls. On buildings which have been furnished to set on posts, no joist headers are necessary as the ends of the joists can be spiked to the sills. If the sections of joists on both sides of the house are spaced the same, it is a good plan to lay the two sets of joist headers alongside of each other and mark them both at one time. One set of the joist headers can also be used to mark off the spacing on the center girder. This will insure the joists being laid parallel with each other.

At the side of the joist plan, you will notice there are dimension lines which indicate the joists that the sub-floor will break on. Be very careful to have these joists placed as shown, then nail them in between the headers, spiking thru the header into the end of the joist and toe-nailing the joist to the sill or sills. In case any of the joists should have a bow in them, be sure to place joists with bow up. The weight of the floor and walking on it will bend in back straight. If the bow were placed down, it would make an uneven floor.

Well openings in the joists should be placed exactly as shown and of correct size in order to have the stairs fit properly. It is a good plan if you have decided the location of chimneys to cut the openings for same before the joists are floored over. Be sure to cut these openings so as to leave about an inch or 1½ inches between headers and chimney.

We have shown on plans where it is necessary, double joists or inserted extra ones to take care of bearing partitions. It is also a good plan if you are going to place some extra heavy piece of furniture in a certain place to have that part of the joist doubled up with material marked "Extra."

It is a good plan after you have the joists laid, to be sure that they are perfectly level and square before starting the erection of the building, as it is very difficult to build a foundation and have it perfectly level on top. Should this be the case, the joists can be wedged up so as to make them perfectly level. Sixteen "D" nails have been furnished to nail joists. This will complete the laying of the first floor joists.

If it is necessary to notch out any of the joists in order to complete runs in plumbing or heating pipes, the balance of the joists should be doubled up to prevent a shaky floor. This probably would not be noticed so much on the first floor joists, but the plaster is very apt to be damaged if such were the case on the second floor.

Wood Bridging

After the floor joists are leveled up, and securely nailed in place, and before the sub-flooring is laid, they should be bridged at the middle of the span for span from 8 to 16 ft. single row of bridging and two rows of bridging should be placed in span over 16 ft. in length. Note nailing of bridging in Fig. 174. For dwelling house floors, 1x3 in. bridging is sufficient. The pieces are cut on a miter at each end and to exact length. Each end of piece is to be nailed with two 8 "D" nails. Both ends of each piece of bridging should be nailed at the same time, and before the joists are loaded in any way, and the bridging should be continuous and in a straight line across building.

It must not be understood that bridging increases the strength of a floor so that it will carry a greater distributed load than it will support without, for this is not the case, except that it will prevent the joists from twisting or buckling sideways. The principle advantage derived in the use of bridging is in a case of concentrated load, such as legs of heavy pieces of furniture, and also in the case of suddenly applied live or dead loads not equally distributed. In such cases the joists directly under the weight are moderately assisted thru the bridging by the joists on each side of it, which in many cases prevent the cracking of plaster.

Bridging is cut to exact length and in cases where the first and second floors are of different dimensions, the bridging is furnished accordingly.

First Floor Sub-Flooring

The material to be used for first floor sub-flooring has all been stenciled "Sub-flooring First Floor." It is intended that the sub-floor sheathing shall be laid directly over the first floor joists. You will find that the sheathing has been cut to length as indicated on Fig. 3 or joist plan of blue prints. Carefully nail this sheathing to joists and draw it tightly together, using 8 "D" nails for this purpose. When laying the sub-flooring work over from one side of the building about 9 or 10 ft. and then part of the building crew or men in charge can be getting material laid out for the wall which is to be erected on that side while the other men are finishing laying the balance of sub-flooring, working from the other side. The finish flooring has been furnished to run in the opposite direction to the sub-flooring, and has been cut to extend across the entire building. It is not advisable to lay this until after the plaster or plaster board has been put on, in which case it will have to be cut to go in between partitions and walls. The foreman in charge should always have sufficient work laid out or planned ahead on an operation of this kind so that the men will be busy at all times; a stop of work for five minutes at a time amounts to considerable when the job is completed. Don't let your carpenters spend their time sorting out or collecting material; this can be done by common labor or boys.

Erecting Frame Outside Walls

You are now ready to erect the frame for the outside walls. Carefully study the figure on blue prints, and note that the walls are so constructed as to interlock at the corners. The walls consist of floor plates or the plates which

are nailed to the sub-floor of the building, upright studs, window and door headers and two sets of wall plates, or plates which cap the upright studs. The longest walls of the building, or the walls which run the same way as the sub-floor, should be erected first. In this manner, time can be saved, as one man can be laying out the walls as soon as a few feet of sub-flooring have been laid across the joists.

Fig. 175—Methods of laying out wall plate.

To lay out the walls, first lay the floor plates on top of the sub-flooring and lay one set of top wall plates alongside of them; now space off with a

Fig. 176—Wall nailed together on floor of building.

steel square, the location of the upright studs in the wall. Space the window openings first, and also be careful to see that the studs indicated by arrows on blue prints for sheathing to break on, are placed exactly as shown. This will do away with any cutting of sheathing. See Fig. 175, which shows

Fig. 177—Wall being raised into position.

methods of using steel square for laying out spaces on plates. After this is done, lay these plates on the floor of the building and nail the upright studs in between them; then nail in place the window and door headers, cap wall with second set of plates. Note Fig. 176, which shows all the frame for one wall nailed together ready to be raised into position; raise it into position

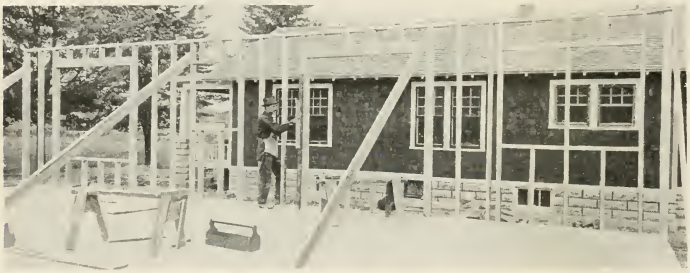


Fig. 178—Wall in position. Note temporary supports.

and spike to floor of building. Carefully study Fig. 177 and Fig. 178, which show wall being raised into position and wall raised and held in place with supports. Square and plumb the wall and nail in place sufficient temporary supports until the remaining walls and partitions have been erected.

You will note that temporary supports are tacked on upright studs before they are raised in place. In this manner the wall can be raised with less men. The opposite end of supports is tacked to a small block on top of the sub-flooring and securely nailed after wall has been squared up.

All the outside walls should be erected in the same manner. If the building has two stories, the second story outside walls will be erected on top of

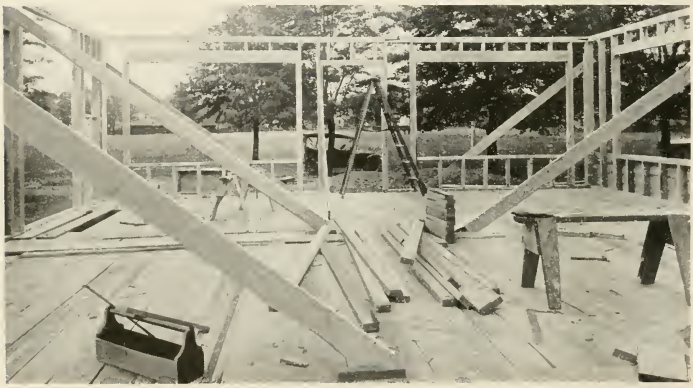


Fig. 179—Note braces on three walls.

the sub-flooring of the second floor in the same manner as the first story walls. At the corners where the wall plates intersect, they should be carefully spiked together.

Sixteen "D" nails have been furnished for frames of walls.

It is always a good plan to space off on top of the walls the location of the second floor or ceiling joists before raising them into position. The location of the rafters can also be indicated in the same manner.

Partitions

After the frames of the outside walls have been finished, the partitions should be erected so as to strengthen the walls before nailing on the sheathing. You will notice that the different partitions have been given a figure number which will correspond with the figure number on the floor plan of the building. There is also a scale around the floor plan which shows the exact location of each partition. Erect these walls in the same manner as the outside walls by nailing them together upon the floor of the building and then raising them into position. Be very careful that the partitions run square with the outside walls. The necessity of having all walls and partitions square and plumb will be appreciated in case you wish to place some article of furniture or built-in fixture in the corner of a room. The scale on the floor plan of the building, you will notice, gives the distance from outside to center or from center to center. For example, suppose a partition is to be set back 12 ft. from the front wall; measure back 12 ft. at each end of partition and then drop back 27⅛ inches and drive a nail in at each of these points; place a chalk line across these nails and bring your partition up to within 1 inch of the line and then try a 1-inch block in between the line and partition. Carefully spike

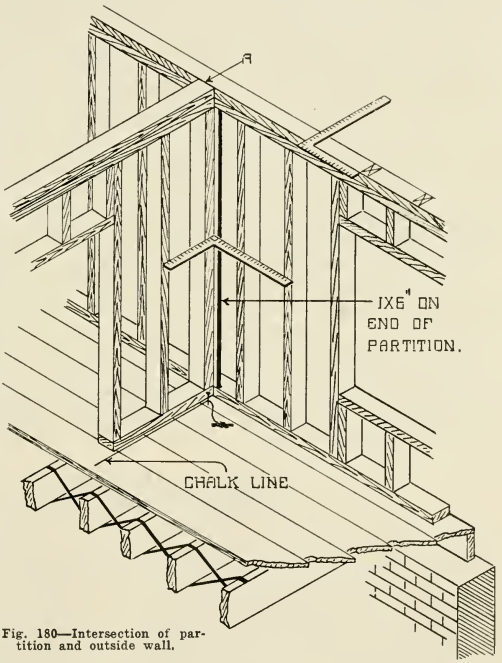


Fig. 180—Intersection of partition and outside wall.

the partition to floor of building, plumb it up with the use of a "plumb bob," and try a steel square in the corner that it forms with the outside wall before spiking it to the other partition and outside walls.

Another thing to remember is to pick out straight studs for forming doors and arch openings and be sure they are plumbed up. This will make it much easier to set frames. The temporary supports holding the outside walls are apt to interfere with the erection of the partitions to some extent, but they should not be removed unless absolutely necessary until after the partitions have all been erected, and outside walls have been sheathed over.

On bearing partitions or partitions which support the break in ceiling or second floor joists, it would be a good plan to mark off the spacings of the joists on the top plates before the partition is raised into position. It will be much easier than climbing across the top of them.

All bearing partitions, that is, partitions which carry the break in second floor joists, or an extra amount of partition material above them, should be supported by the foundation girder or extra joist placed to even up the load.

All interior partitions are constructed of single 2x4 studs excepting special arch partitions and those for sliding doors. Partitions for Arch 2A-1, 3A-1, 2B-70 and 2B-72 are constructed of 2x8 in. studs or two partitions constructed out of 2x4's. Partitions for sliding doors are made out of 2x4's, but these partitions are double and are placed with sufficient space between them to allow for recess to admit the track and doors.

For the ends and tops of the partitions we have furnished pieces of sheathing so as to form corners to take the lath or plaster board. These should be nailed in place before the outside walls are sheathed up.

Sixteen "D" nails have been furnished for nailing partitions.

In a two story house the second floor partitions will be erected in the same manner as the first floor, only on top of the sub-flooring of the second floor.

Fig. 180 shows method of using steel square in corners formed by partitions and outside walls of two partitions. It also shows it in position to space second floor joists. As mentioned before, it is a good plan to space off the location of the second floor or ceiling joists on top plates of outside walls before raising them in place.

Sheathing Outside Walls

The sheathing which has been furnished to sheathe outside walls is 1x6 in. and is furnished in lengths as shown on blue prints; it is intended to be placed horizontally over the studding. The outside wall sheathing has been marked "Outside Wall Sheathing." Commence at the bottom of the walls and sheathe up, alternating the lengths as shown on blue prints and dodge-nail the sheathing, that is, nail near the bottom of a piece on one stud and near the top on the next stud. Put two nails in the end of each piece. Considerable time can be saved in putting on sheathing if these strips of sheathing running the length of the building are just tacked while being put in place. Then you can start in nailing up on each stud and a man will become very efficient in nailing, and also do away with the lost motion of putting away his hammer each time he wants to put a board in place. Although it is not necessary to fill each board up with nails, all should be securely fastened to the stud-

ding. We furnish 35 pounds 8 "D" nails to nail on 1,000 board ft. of sheathing. There are 93 8 "D" nails in a pound.

Therefore, you will have about 3,250 nails to nail on 1,000 ft. of sheathing. In 1x6 in. material there will be 2,000 lin. ft. in each thousand board feet.

2,000 divided by 3,250 equals 0.615 ft. or 1 nail to about every 7½ in. The joints of the wall sheathing should break on the studs as shown by indicating arrow on blue print plans. If you find that the studs have not been spaced properly to take the joints, other studs should be set in.

On short runs, such as between a window and corner of building, all the pieces can be tacked in place first and then you can start in nailing down a stud. In this manner the building can be sheathed up very rapidly. When you find that the piece of sheathing extends into the window or door openings at top or bottom, it is much quicker to nail piece on wall and then chop out with small hand axe than it is to mark and saw out before putting it on wall.

Besides being marked "Outside Wall Sheathing," the sheathing also has the lengths marked on the different pieces. Pick out all those necessary for one wall, that is, the correct number of pieces of each length, and put them up close to walls where they can be reached easily.

The gable sheathing or any section of sheathing with a special miter will be bundled together and marked for "gable sheathing," or the figure in which it is to be used. The pieces are also numbered consecutively in the order they are to be used.

The second story walls will be sheathed in the same manner as the first. The gable sheathing, of course, cannot be placed until after the rafters and gable studs have been erected. On some buildings with boxed eaves you will notice on blue prints that the "Return" extends back into the wall stud; in such cases you will not sheathe up to the top of walls.

The sheathing has been bundled with five to ten pieces in each bundle, but the lengths contained therein will only be marked on the top piece. Therefore, it is a good plan if you break open the bundle to leave the piece with the length on it or mark the remaining top piece of the pile. This small precaution will save a lot of unnecessary measuring.

Second Floor Joists

The second floor joists are shown by the figure following the first floor partitions. This figure shows the arrangement of the joists as they are to be placed across the top of first floor partitions and first story outside walls. It also shows the arrangement of the sub-flooring across top of second floor joists and the lengths of finish flooring. Space off on the top plate of the outside walls, the correct distance where the joists are to be placed; also mark off the distance on the bearing partitions or partitions that the joists break on. At the side of the joist plan, you will notice dimension lines which indicate the joists that the second floor sub-flooring will break upon. Be very careful to have these placed exactly as shown; then nail the joists in place, carefully spiking them down to the top of partitions and walls. Next, put in the wood bridging on the second floor joists in the same manner as you did on the first floor joists. Be sure that the well opening for stairs comes exactly as shown. In case any of the joists should have a bow in them, be sure to place joists with

bow up. The weight of the floor and walking on it will bend it back straight. If the bow were placed down it would make an uneven floor.

Lay sub-floor for second floor in same manner as you did first floor, using 1x8 inch material marked "Sub-flooring Second Floor." Work in from the ends of joists; this will enable the foreman to have the two side walls laid out by the time the other men are thru laying sub-flooring.

In two story buildings the next step will be to erect the frame of outside walls, second floor partitions and then sheathe second story outside walls.

Ceiling Joists

On a one story house the ceiling joists will be shown by the figure following the first floor partitions, and on a two story, by the one following the second floor partitions. This figure will show the arrangement of the ceiling joists as they are to be placed across the top of the outside walls and partitions. It will also show pieces of sheathing nailed on top of partitions to form corners on which to nail lath or plaster board, wherever it is needed. It is a good plan in a one story building to space off the location of the rafters on top of the outside walls at the same time that you do the ceiling joists; then if it is necessary to "off set" one of the ceiling joists, you can do so before it has been nailed in place. After carefully nailing the ceiling joists in place, the temporary supports of the outside walls can be removed. Nail the ceiling joists on the bearing partitions first, and then if the outside walls have sprung put in additional braces to straighten them up until the ceiling joists have all been securely nailed. If any of the ceiling joists have a bend or bow in them, be sure to place the bow up, to insure an even ceiling. In two story buildings the ceiling joists should not be put on until after the outside second story walls have been sheathed over.

Roof (Kinds)

THE style of roof, method, and cost of construction, and the easiest and quickest way to erect, is a matter of considerable importance to carpenters and builders. The styles of roofs and the proportion of their shape and size to fit the house, have a great deal to do with the appearance when the building is complete. It is also very important that the roof be erected in the proper manner so that eaves, ridge, hips and valleys are all in line.

Figs. 181, 182, 183, 185, and 187 represent five styles of roofs in general use on ALADDIN buildings. These when used singly or in combination and with variation to meet the requirements of different buildings, constitute the larger part of the roofing of the average building.

Fig. 181 represents a plain gable roof, Style "B."
Fig. 182 represents a four gable roof, Style "E."
Fig. 183 represents a shed roof, Style "A."
Fig. 185 represents a hip roof, Style "D."
Fig. 187 represents a gambrel roof, Style "C."

Gable Roof—Style "B"

The gable roof is one of the most common roofs in use and is very easily constructed. It is of the plainest type, yet when given the proper pitch and proper width of cornice, will give a satisfactory and pleasing appearance.

The rafter plan on the blue prints will show the arrangement of the rafters over the walls of the building and the correct distance between them. It also shows the ridge which is to go between the rafters at the top. The different lengths of roof sheathing are shown laid across the top of the rafters with lengths alternated.

Fig. 181—Plain gable roof.

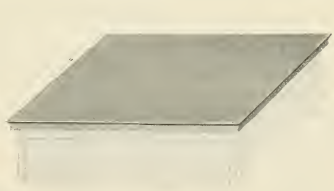


Fig. 182—Shed roof.

To erect the roof, first place sufficient planks on top of the ceiling joists to enable a couple of men to move around with horses of sufficient height so a man can reach up to the ridge. Then take the pieces of material the correct length shown on blue prints for ridge pole and measure off on them the same distance marked off on the top plates of the outside walls, or where the heel of the rafters is to set. Then start at one end of building and commence nailing the rafters on both sides of the roof. Be very careful to see that the ridge is kept perfectly level and in line. A chalk line should be placed on the end of the rafters, and if when all rafters have been erected, you find that one does not line up, trim it off. A few pieces of roof sheathing should be nailed on the

rafters as they are being erected, so as to help keep them in line and to be sure that the rafters on which the sheathing is to break, are placed exactly as indicated by dimension lines on blue prints. The rafters have all been cut on a patent rafter machine, making them uniform in length and the miter exact.

If the walls of the building are out of plumb, it will affect the rafters and ridge, and sometimes this makes it necessary to lower one rafter and raise the one opposite it in order to bring the ridge in line.

It is a good plan to find the center of the two gable walls and raise a temporary stud at each end of building and stretch a chalk line with plum bob, bringing the center of the ridge in line with bob. Pieces can also be nailed on walls below the two gable ends, so that the first and last pair of rafters will be plumb with the framing of the side walls.

Gable roofs are constructed in three styles. First, with exposed eaves; second, with boxed eaves, and third, with straight return boxed eaves. See paragraph on eave construction for different eave constructions.

Shed Roof—Style "A"

Fig. 182 is a shed roof, which is one of the simplest forms of roofs. It is principally used on additions to the main roof and in the construction of dormer roofs, particularly on roofs of the bungalow type. The upper end of the rafters generally rest against one of the side walls of the building or run up on the main roof. The same care should be taken in keeping the rafters in line and correctly spaced as in the gable roof. The shed roof is just a half gable roof. Sometimes it is constructed with a ridge and it is also constructed so that the top of the rafters will rest against the sheathing of the walls or part of the building it is constructed on. The eaves of the shed roof are constructed to correspond with the eaves of the main building.

Four Gable Roof—Style "E"

This roof is constructed in exactly the same manner as a common gable, only it is to cover a building which has four gables, similar to the design "Yale." This style of roof is constructed of ridge, main rafters, valley rafters and valley jacks. See Fig. 183. It is more difficult to erect than the plain gable on account of the roof forming valleys. In erecting this roof, the pieces of ridge should be selected and the location of the rafters spaced off on them same as on the top plates of the walls. Then commence raising the rafters at each end of the main roof until you get up to the point where the valleys and valley jacks are to come.

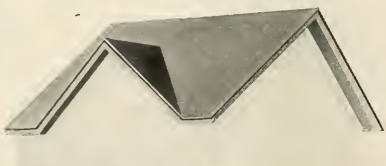


Fig. 183—Four-gable roof.

Now start in the same manner to erect the other two gables; first lining up the ridge and then set in place the first pair of gable rafters. The valley rafters will be set in place and then the valley jacks, which are the small mitered rafters that go from the ridge down to the valley rafters. Be careful

when nailing the valley jacks in place that you do not crowd the valleys out of line.

Be sure that all the rafters are placed the exact distance apart and nail on temporarily enough pieces of roof sheathing to keep them lined up. Chalk line and plumb bob should be raised over the ridge to insure the rafters being placed in the exact center of the span, and guide studs nailed on the side walls to bring the first set of rafters in line with the frame of the side walls of the building.

Four gable roofs have the advantage that the gable space can be utilized as head room on the second floor of the building. When this is done the "collar beams" which form the ceiling joists over the second story rooms will strengthen the roof. Fig. 184 shows a detail frame of a four gable roof, and the location of the different rafters. Letter A indicates the ridge; B the main rafters; C the valley rafters, and D the valley jacks.

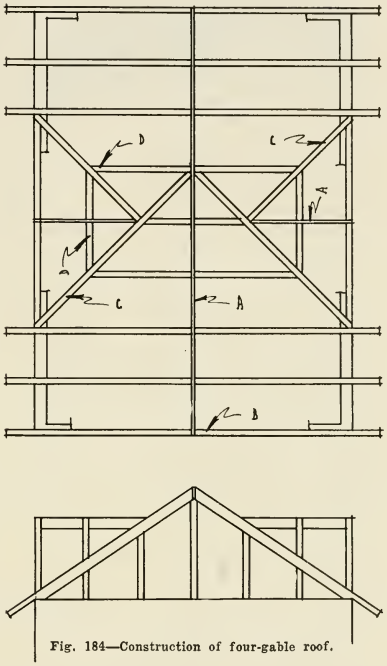


Fig. 184—Construction of four-gable roof.

Hip Roof—Style "D"

Fig. 185 shows the outline of a plain hip roof which rises by equally inclined planes rising from each other. This style of roof is used considerably and is probably the most difficult and expensive to erect. A hip roof consists of four different kinds of rafters, namely: ridge rafters, or the pieces which run along the top of the roof in between the main rafters; Letter "W," main rafters, or rafters which run from the ridge down to side walls; Letter "X," hip rafters,

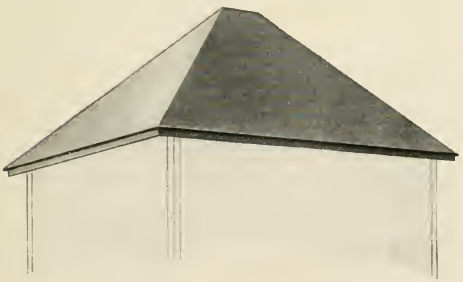


Fig. 185—Hip roof.

or the pieces of timber placed in an inclined position at the corners or angles of roof; Letter "Y," jack rafters, or rafters which run from the hip down to the side walls of the building; Letter "Z," the hip and main rafters are all cut the same, while the jack rafters are cut in pairs with right and left cut.

To erect a hip roof, first mark off on the top walls of the building the location of the rafters, or where the heel of the rafters will set. Then take the ridge and mark off on it the location of the main rafters which run up to it. Next raise the ridge into position and place at each end of it, three main rafters, two at each side and one at each end. Get this part of the roof leveled up and braced in good shape, then nail in place the rest of the main rafters. Now put up the hip rafters, tacking each one in place until they are all up and you are sure they have not forced the ridge out of position. The jack rafters should be put on in pairs so that the hips will not be thrown out of line. Work the rafters around the building so you will not have it one sided, that is, when a pair of jacks have been placed on one hip, place another pair of the same length on the next hip and so on around the building.

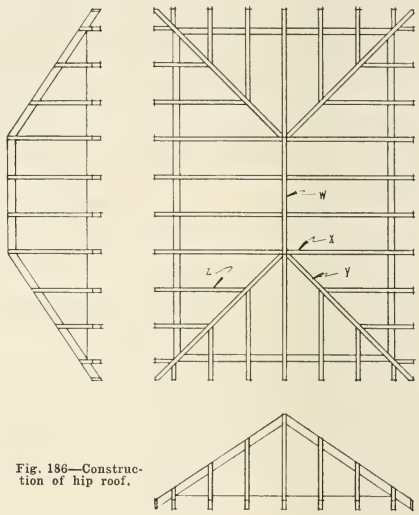


Fig. 186—Construction of hip roof.

Care should be taken to see that the ends of the rafters are kept in line where they project over the side walls to form eaves of building. A chalk line should be placed from one hip to the other and the rafters lined up to it.

The eaves of hip roof are constructed in three ways: First, exposed eaves; second, boxed eaves, and third, straight return boxed eaves. (See paragraph on eaves.)

Pieces of roof sheathing should be nailed temporarily over the rafters as they are being erected, to keep them spaced properly and in line.

Fig. 186 shows detail construction of a hip roof. Letter "W" indicates ridge; "X," main rafters; "Y," hip rafters, and "Z," jack rafters.

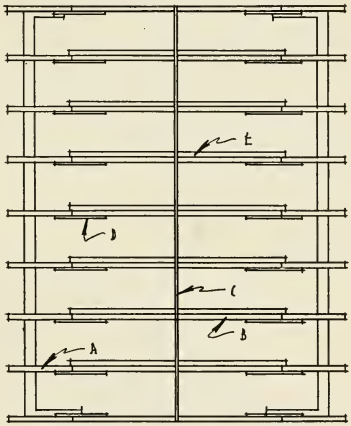
Gambrel Roof—Style "C"

Fig. 187 shows a sketch of a "gambrel" or "curb" roof, which is a roof that has two pitches, the first run of rafters in most cases forming the side wall for the second story of the building. At the top of the ceilings of the second story the roof breaks and continues up to the ridge by a second

run of rafters. These two sets of rafters are notched, so as to fit at the break in the roof and strengthened by a 1 inch piece of sheathing mitered for tie plates. This kind of roof is strong and is used considerably as it will almost make a two story building out of a one story, because the first section of the roof is so steep that it makes the second story space nearly all available for rooms. It is typical on colonial designs.

Fig. 187—Gambrel roof.

In constructing this roof, it will be necessary to use some temporary supports to hold rafters in place at the break in roof until after the tie plates and collar beams have been nailed on. Oftentimes partitions are located under these breaks in the roof, and in that case they should be erected before rafters are put up. To be placed between the rafters which run up to ridge of building there have been furnished some pieces of 1 inch or 2 inch material marked "Ridge Pole," which will aid in strengthening the roof.



First place a chalk line and plumb-bob in the center of your building as a guide to line up the ridge. Then if the building has partitions which will support the break in the roof, erect them at this time; if not, erect some temporary supports at this point. Mark off the location of the rafters on the top plate of the side walls and the pieces of ridge. Then raise the rafters on each side of the roof in pairs, nailing the tie plates to the rafters at the break. The collar beams running between these rafters should also be nailed in place as the rafters are being erected.

Place pieces of roof sheathing temporarily over the rafters to keep them lined up and spaced properly.

Fig. 188 shows detail construction of gambrel roof. Letter "A" indicates lower rafters; "B," upper rafters; "C," ridge; "D," tie plates; "E," collar beams, and "F" shows furring strips to nail lath or plaster board to. Place chalk line on ends of rafters to keep them lined up.

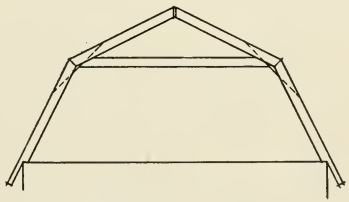


Fig. 188—Construction of Gambrel roof.

Collar Beams and Furring Strips

When collar beams have been furnished to strengthen the roof or to form ceiling joists over the rooms of a building which does not run up full two stories, you will find a cross section of roof on blue prints, which will show the location of the collar beams and size of material that they are made out of. You will find that the collar beams have been mitered at each end on the same pitch as the rafters of the roof. To put in the collar beams, place one at each end of the roof between the rafters, measuring up the correct distance from the top plates of side walls shown on blue prints. Place a level on them and then stretch a couple of chalk lines the length of the building on the top or bottom edge of these first two collar beams and bring all the rest of them up to the lines, carefully spiking them on the side of the rafters.

In buildings where the collar beams form the ceiling joists of the second story rooms, they will be placed on the 24 inch center the same as the rafters of the roof. In this case the plaster board or lath and plaster will not fit on them, and 1x3 in. furring strips have been furnished to be placed on 16 in. center under the rafters and collar beams to which will be nailed the lath or plaster board. This will save cutting the wall covering. Refer to Fig. 188 which shows furring strips nailed to rafters and collar beams.

Gable Studding and Sheathing

In gable, four gable, shed and gambrel roofs there will be a certain number of mitered studs in the gables of the buildings. These mitered studs you will find tied together and marked with lengths to correspond with lengths shown on pieces in gable on blue prints. The bundles will also be marked with a figure number to correspond with the figure number on the blue prints to which they belong.

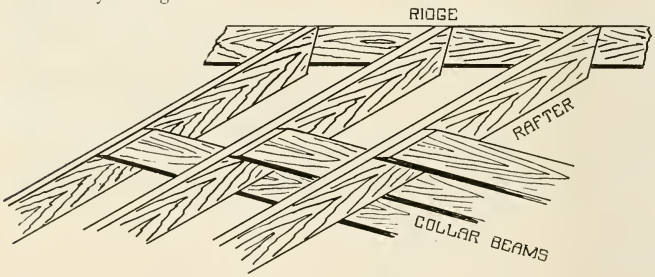


Fig. 189—Position of collar beams.

In nailing the mitered studs in gables, always start in the center of the roof or ridge and work down toward end of rafters. This will prevent you from driving them in place too tight and springing rafters out of place. You will also find that the gable sheathing has been mitered and tied up in bundles and marked for the gable to which it belongs; the pieces are also marked with a length and a number to correspond to the number shown on pieces in detail of gable. You may find three pieces marked No. 1. By referring to detail of gable sheathing, you will notice that these pieces when properly placed will go

across your building and the break will come on the gable studding. The next set of pieces will be marked No. 2 and so on up the gable.

The gable sheathing has all been cut to go from the top plate of side wall up to ridge. Do not start to nail on the gable sheathing below the top plate; if the last piece of side wall sheathing does not come up to top plate, a piece should be ripped to fit in here. If the gable studs are properly placed and the gable sheathing put in place according to set numbers, the breaks will always come on the studs as intended.

After the gable sheathing is all nailed in place, it is a good plan to use a straight edge and level or plumb-bob to be sure the gable section is in line with the main walls.

Do not let any pieces of gable sheathing project up above top of rafters, as these will raise the roof material out of line.

Roof Sheathing

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing," and has been furnished in lengths to correspond with those shown on blue prints. When wood shingles are furnished, the roof sheathing comes in 1x4 inch widths and is to be placed over the rafters, laying it two inches apart, that is, a piece of sheathing and a space should cover six inches. The sheathing is so spaced in order that air can get underneath the wood shingles and help in drying them out after they have become soaked by heavy rains. If the roof sheathing is laid tight, the space between the shingles and the roof sheathing is very apt to become moldy in damp weather. In placing the sheathing over the rafters, each run should be alternated as shown on blue prints, that is, no two joints should come directly above the other on the same rafter.

On hip or valley roofs where sheathing is to be mitered, you will find a detail on last sheet of blue prints. These mitered pieces will all be bundled together and marked with the lengths which will correspond to the lengths shown on blue prints. Where the roof sheathing projects out over the edge of the rafters, as in a gable roof, a piece of sheathing should first be nailed up at the ridge of building and one at the lower end of rafters, giving them the exact projection over the eave, and chalk line run from one piece to the other. This will keep the pieces of sheathing in line and it will not be necessary to trim up after all the sheathing has been put on.

It is a good plan to make two or three little blocks

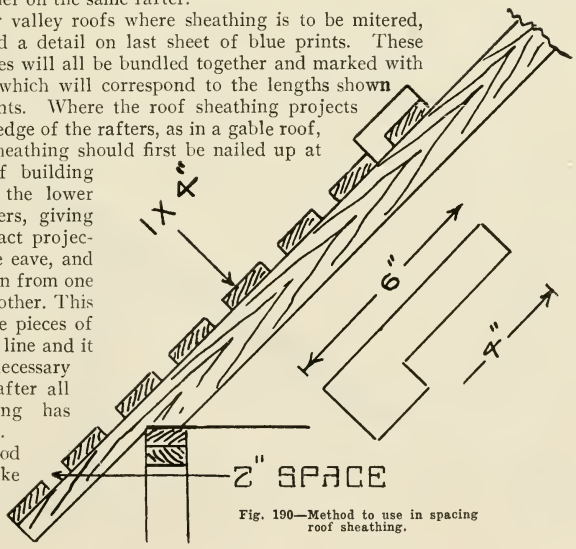


Fig. 190—Method to use in spacing roof sheathing.

such as shown in Fig. 190 to use in putting on roof sheathing; tie short pieces of string on these blocks and fasten one end of string to buckle of overalls or any handy place. This will do away with the handling of rule and save considerable time.

When semi-slate shingles, roofing, tin or slate are to be used for roof covering, the roof sheathing is usually furnished in 1x6 inch width, to be laid tight together over rafters. This is necessary because these roofing materials are flexible and the weight of snow on roof would spread material between roof sheathing if it were spaced.

On roofs that have exposed eaves, that is, where the end of the rafters are not boxed in, we furnish narrow beaded ceiling to cover rafters wherever they can be seen from underneath, so as to give the eaves a neat appearance.

The different lengths of ceiling will be shown on blue prints with lengths alternated same as roof sheathing. It is intended that the ceiling is to go from ends of rafters up to top plates of side walls, and roof sheathing is to be placed from there up to ridge. It has also been furnished to extend out over eaves on gable roof buildings, in which case it is cut long enough to extend back and give it a bearing on the second set of rafters.

In putting on the ceiling, commence at ends of rafters and be very careful to drive each piece tightly down against the preceding one, and toe-nail the ceiling in place. This will prevent the joints from opening up.

The roof sheathing should be "dodge-nailed" in the same manner as the side wall sheathing. The isometric detail of eave will show if the roof has exposed eaves which are to be covered with ceiling or if the eaves are to be boxed in. Refer to last sheets of blue prints, and carefully study eave paragraph and detail.

Eaves

The eaves of the building deal considerably with the general appearance of the building. Correct projections and construction must be used in order to carry out satisfactory and pleasing lines.

Three styles of eave construction are in general use on Aladdin buildings. "Exposed Eaves" are eaves where the rafter ends are left exposed as shown by Fig. 191. This form of construction is very simple and pleasing to the eye on buildings requiring a rustic appearance, such as bungalows with wide over hanging eave projection. The full width of the rafter is left projecting over the side walls of the building with a plumb cut on the end; that is, the end of rafter will be mitered so it will be in line with the side walls of the building.

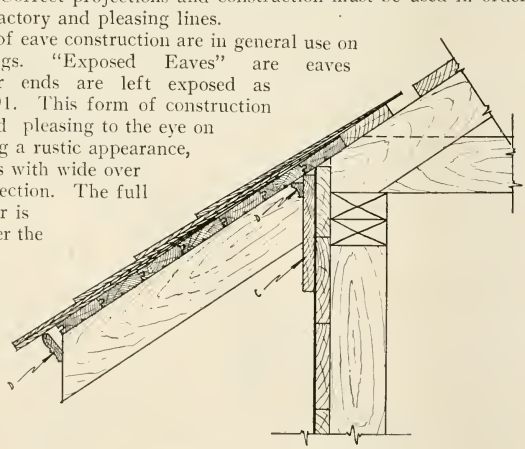


Fig. 191—Detail of exposed eave.

The gable ends of this style of roof are finished with a heavy facia (sometimes termed "verge" or "barge board"). This "facia" is nailed on the under side of the ceiling which projects out over the gable ends. A molding is furnished for the ends of rafters to give them a finished appearance under the shingles or roofing covering.

The rafters on exposed eaves are covered with narrow beaded ceiling, which is also furnished for the eave projection over gables on gable roofs to give the eaves a neat appearance from underneath.

Fig. 192 shows a boxed eave which is constructed by boxing around the rafter ends or projection with finish material. On the end of the rafters is nailed a 1x4 or 1x6 inch piece (depending on the size of the rafter) of finish called facia, (sometimes termed "verge" or "barge board"). These pieces close up the end of rafter and extend up into the gables of the building and are nailed on the ends of the roof sheathing projecting out over the gables.

For the under side of the rafters, pieces of 1 inch material are furnished called "plancier." These pieces close up the under side of the boxed eave, and also continue up into gable. The bottom side of the facia is nailed into the edge of the plancier. Short pieces of 2x4's have been furnished to go between the roof sheathing and plancier to furr it down to same thickness as end of rafters. In Fig. 192 "A" shows facia, "B," plancier, "C," frieze, and "D" moldings.

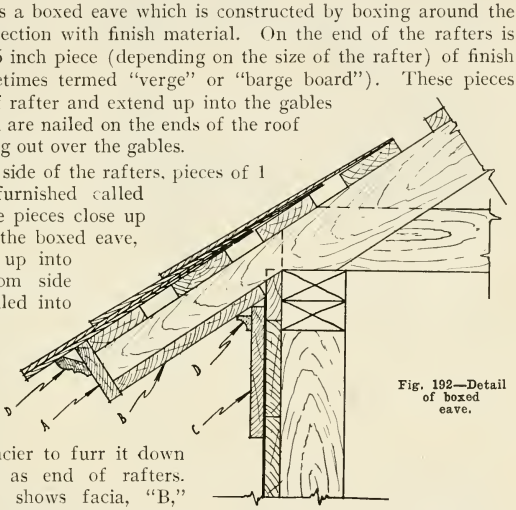


Fig. 192—Detail of boxed eave.

Small moldings have been furnished to finish eave between roof shingles and facia and between plancier and frieze. These moldings continue around the entire building on the eaves.

Fig. 193 shows detail construction of a straight return eave commonly used on houses of hip roof construction and also on porches. This eave is constructed by nailing a one or two inch piece of material straight back from the end of rafter to side wall sheathing, or sometimes nailed to side wall studs. A piece of 1x4 or 1x6 inch material is furnished to go on the end of the rafters called "facia." The under side of the return is boxed in with narrow beaded ceiling or 1 in. material for plancier. If narrow beaded ceiling is furnished, it should be toe-nailed to return and drawn tightly together so the joints will not open up. The joints of the ceiling or pieces of finish material should all break on the return.

Pieces of molding have been furnished to go between the facia and roof shingles and between the plancier and frieze.

On the last sheet of the blue prints you will find a quarter or half full

size detail of eave construction showing the exact size and kind of material to be used for this purpose. All the material will be marked "Eaves."

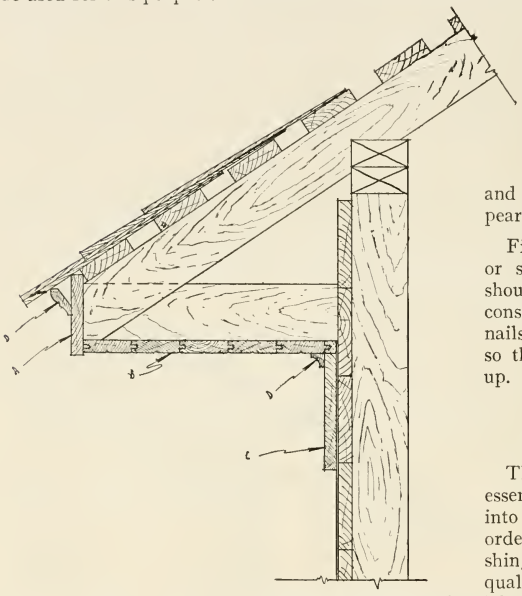


Fig. 193—Construction of boxed eave, straight return.

Be sure that the ends of these rafters are all lined up with the building, so when the cornice is finished it will not have waves in it and will give a neat appearance.

Finishing, eight case or small headed nails should be used on eave construction and the nails set into the wood so they can be puttied up.

Shingling

The first and most essential thing to take into consideration in order to have a lasting shingled roof is the quality of the shingles. The shingles used with Aladdin buildings are of the best grade of cedar shingles which can be obtained, and when laid according to following instructions will give satisfaction and long service.

The second is the manner in which they are laid on the roof and the method employed in laying them. Considerable time and labor can be saved by carefully studying over the following instructions; but do not risk work on shingling with inexperienced men, for you are very apt to get a leaky, unsatisfactory roof if you do.

The shingles are to be laid 5 inches to the weather and nailed with a 2 "D" galvanized shingle nail furnished for that purpose. The shingles are to start at eave with the first course 2-ply and giving the first course about 1½ inches projection down over eave at end and about 1 inch over eave in gables.

Break all joints at least 1¼ inch and be sure that no break comes directly over another break in any three consecutive courses, thereby covering all nails. The shingles should be nailed about 6½ inches from butt and about 1½ inches from side. Use two nails on each shingle. Shingles which are wider than 10 inches should be split before being placed on roof. Lay shingles so that water in running down roof will run with the grain and do not drive heads of nails into shingles or let them project up; they should be just flush.

Flat grain shingles should be split much narrower than vertical grain

ones and laid right side up, or thrown away, that is, the layer of the grain should lap the same as the layer of shingles already laid on roof.

Shingles which have been dry kilned should be wet thoroughly before laying on roof. If it is inconvenient to do this, lay them about ¼ of an inch apart, so that they will not bulge up when they become soaked with water in rainy weather. Green shingles can be laid close together. When they dry out they will give the necessary space to allow for swelling.

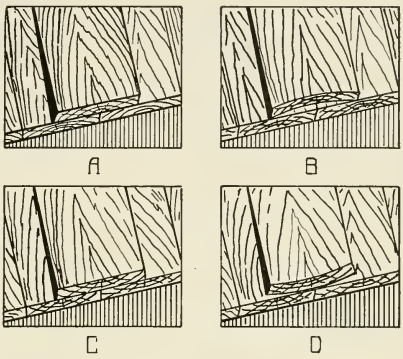


Fig. 194—Proper and improper method to lay shingles.

A good shingler looks at the butt of the shingle and then lays it on the roof as shown by "A" in Fig. 194. If this shingle has any tendency to warp or curl, it will be downward as shown by "B," and will keep the roof tight. If the shingle is laid as shown by "C" it will curl up as shown by "D," and will allow the elements to work under it.

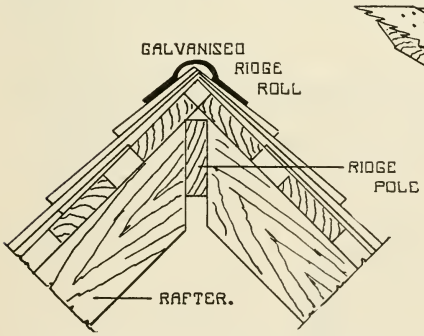


Fig. 195—Metal ridge roll capping ridge of building.

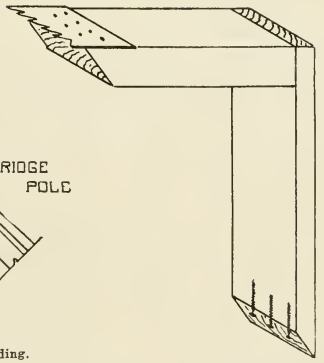


Fig. 196—Shingle seat.

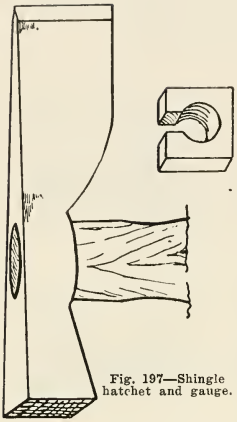


Fig. 197—Shingle hatchet and gauge.

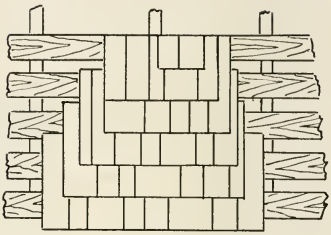


Fig. 198—Proper way to lay shingles.

Valley tin has been furnished for roofs which have valleys, and hip shingles for hip roofs. The valley tin will be placed before the shingling starts, but hip shingles are to flash over wood shingles. If you do not care to use tin hip shingles, finish hips by using a course of even width narrow shingles on both sides of hips over regular courses.

Metal ridge is also furnished to cap the ridge of the roof wherever it is intended. See Fig. 195. The lengths of ridge roll should lap each other enough to prevent leaking and are better if soldered.

In shingling it is very essential especially to the appearance of the roof, to keep the courses lined up. Some carpenters prefer a chalk line, some a straight edge, and the greater number use a gauge or shingling hatchet and only line up about every 10th or 15th course. By using a gauge or shingling hatchet, the time it takes to change chalk lines and straight edge is eliminated and cuts the cost.

A shingling gauge which is as good as many of the patented ones, can be made out of a common nut from a ⅜ inch bolt. Cut a slot with a hack saw, as large or larger than the thickness of the hatchet blade, then close up with hammer until it will make a good fit. Now drive it on the blade the same distance from the sharp edge of the hatchet as you want to lay the shingles to the weather. See Fig. 197.

An easily made shingle seat can be constructed as shown by Fig. 196, which makes it a lot more comfortable to stay on the

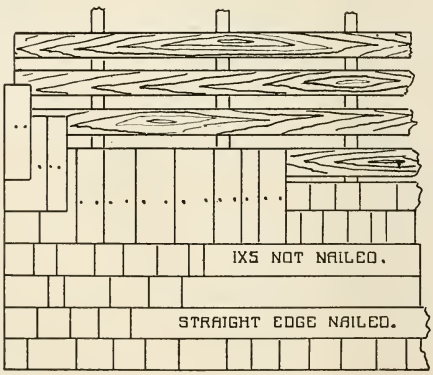


Fig. 199—Use of short straight edge.

roof. This is built by using a piece of 2x8 and a piece of ⅞ inch material nailed on top as shown in sketch; in the end, drive some shingle nails and bend over so the heads will stick out. For steep roofs a piece of old saw can be screwed on end so as to make a seat more safe.

Speed in everything is acquired by the use of proper methods and hard work. A great deal of time is often lost in getting started.

If it is possible on low pitched roofs, do away with raising of scaffolding. On a quarter pitched or less, put a shingle on each end of building, stretch a line, then put on five or six courses with a ladder at one end, just enough to set jack or shingle seat on. Then shingle across, carrying five or six courses at one time. This will get you started without the use of scaffolding.

A good method to keep shingles in line without the use of gauge or hatchet is to place a straight edge on about every 5th or 6th course and cut some short pieces about 2½ or 3 ft. long and five inches wide and just slide one in above the other. Do not nail them. See Fig. 199. In this manner one man can carry five or six courses across and keep them well lined up.

Fig. 200 shows the method of laying one shingle in valley on a line with a valley tin, which makes it necessary to miter but one shingle to a course.

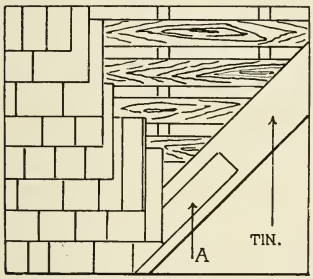


Fig. 200—Method of shingling valley.

Hip shingles will not have to be sawed off, as a sharp hatchet will do the trick nicely. When nearing the ridge of the building, it is always a good plan to use a pole and gauge off on it the courses of shingles so that they will come even at top.

About 2¼ lbs. of 2 "D" shingle nails are furnished for each thousand shingles, and figuring out that the shingles furnished by us are wider than the average, they will run about 700 shingles to 4 bundles (which have a covering capacity of 1,000 average width shingles).

There are 664 2 "D" nails in each pound, and 2¼ lbs. to a thousand shingles. You should have sufficient nails to properly lay all shingles furnished.

Outside Finish

BY referring to the figures which show views of the sheathing and outside finish placed over side walls of building, you will notice at the bottom of these figures pieces marked "Water Table Cap" and "Water Table." The cap over the water table is for the purpose of carrying the water out over the foundation walls. First run a strip of building paper around your walls and hold in place with a few laths, then pick out the pieces of 1x4 inch water table the correct length shown on the blue prints and nail them in place. These pieces have been cut long enough so that you can miter the corners or let one run by the other, just as you prefer. In nailing these pieces on, be sure to have them set level so that when you start your siding, it will be in line. Then nail the pieces of cap in place at top of water table.

At the top of the different figures, you will notice pieces of 1 inch material marked "Frieze." In buildings with boxed eaves, these pieces will come just under the plancier of the eaves; in buildings with exposed eaves, they are to be notched out so as to fit up around the rafters and close up the space left between the top plates of side walls and roof ceiling. These different pieces of frieze also have been cut long enough so that the corners can be mitered if so desired.

On gable roof buildings, these 1 inch pieces of frieze are mitered to fit the pitch of the roof; on buildings that have stucco side wall covering, the pieces of outside finish should be furred out about $\frac{3}{8}$ of an inch in order to give the metal lath and stucco a bearing under them.

The siding as furnished is cut so that it is long enough to go underneath the casing of the window and door frames and the corner boards, which means that the casings and corner boards can be nailed on over the siding if desired. The frames have been constructed with an extra $\frac{3}{4}$ inch siding stop which is the same thickness as the siding at the lap. In case you do not want to trim the siding, this stop should be left in frames and the siding nailed on at this time. We would advise that you trim the siding, as it makes a much warmer job when the building is completed, and gives a better appearance.

The corner boards should be next put in place if you trim the siding. The pieces of 1x3 inch and 1x4 inch material should first be trimmed so as to make a good joint between the water table cap and frieze. Then nail the two pieces together before nailing in place on corner of wall. When the side walls are covered with shingles, all the exterior trim will be placed directly over sheathing.

Sometimes a belt is furnished to form a break between the exterior covering of the first and second story; these pieces should be nailed directly against the sheathing. Be sure that you flash under all outside sheathing with building paper and counter-flash with paper under siding. The outside finish should be put on with 8 case nails and all nail heads set into wood so they can be puttied up.

Outside Window and Door Frames

The window and door frames of your building are a very important part. They must be properly constructed and "set" in order to have the sash and doors perform the work for which they are intended. The window frames in

general use on Aladdin buildings are check rail, casement and stationary. The check rail frame is constructed to take two sliding sash adjustable in the frame, the upper sash drops down and the lower sash can be raised up. Check rail frames are furnished with or without pockets and pulleys, depending on the style and price of the design. The frames are constructed the same, with the exception that when the frame is intended for pockets and pulleys, the side jambs are bored out to take the pulleys.

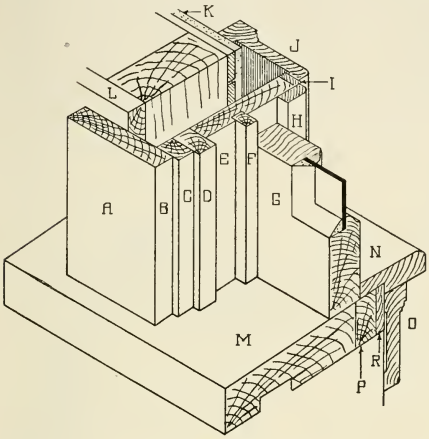


Fig. 201—Checkrail window frames.

The frames are carefully bundled together before shipping and are stenciled for the size window in which they are to be used. The best way to put the frames together is to use a few planks set up on saw horses for a work bench. Untie the bundles and pick out all the interior trim first, such as casings, apron, stool and inside stops. These pieces should be tied together and marked with the window size on them, so when you are ready to use them they can be found easily. Keep the pieces of trim in a dry, clean place.

Refer to Fig. 201, which shows an isometric detail of check rail window frames.

Letter "A" shows outside casing.

Letter "C" shows siding stop which is to be used when you wish the casings to overlap the siding. This stop is not to be used in frame if you wish to trim siding to go between casings and corner boards; this stop is ¾x1 in.

Letter "D" shows outside stop, ¾x1¼ in.

Letter "E" shows side jamb.

Letter "F" shows check stop, ½x¾ in.

Letter "G" shows sash.

Letter "H" shows inside stop.

Letter "I" shows plaster stop, which is only to be used in case that lath and plaster are furnished. Where plaster board is used it is to be kept out of frame. This stop is 5/16x3/4 in.

Letter "J" shows inside casing.

Letter "K," lath and plaster.

Letter "L," outside wall sheathing.

Letter "M," sill; letter "N," stool; letter "O," apron; letter "P," back sill, ¾ inch thick, which is to be left out of frame when casings come directly against sheathing, and one end of the siding is trimmed.

Letter "R" shows back sill, which is only to be used when lath and plaster are furnished, 5/16 inch thick.

After carefully studying the detail of frames, pick out the sill, the head and two side jambs. Nail these together and square them up. Be careful that you place jamb right; note on detail that distance from groove for check stop to the outside of jamb is less than the distance to the inside edge. If lath and plaster are used on your building, nail on the small plaster stops next shown by letter "I." The braces can then be nailed on the inside of the frame to hold them square. Next nail on the outside stops and outside casings, head casing and drip cap. The check stops should be fitted in frame at this time, but should not be nailed in solid; a few small brads will do.

The small 1¼ in. brads, 6 finishing and 8 case nails are intended to be used on the frames. The brads should be "set" so they can be puttied up to make a neat job.

Casement Frame—

Detail of casement frame is shown by Fig. 202.

Letter "A" shows outside casing.

Letter "B," jamb.

Letter "C," sash.

Letter "D," sheathing.

Letter "E," lath and plaster.

Letter "F," casing.

Letter "G," plaster stop. This stop is used only on lath and plaster walls.

Letter "H," siding stop. This stop is not used when you trim siding.

Letter "I," sill.

Letter "J," stool.

Letter "K," apron.

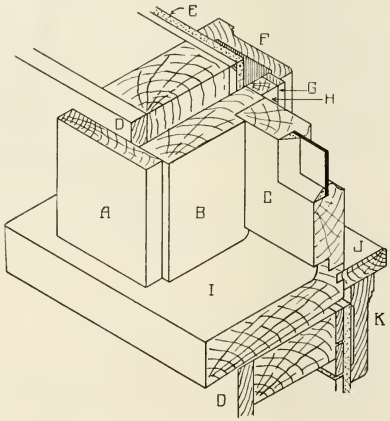


Fig. 202—Casement window frame.

The casement frame is nailed together in the same manner as the check rail; first nailing the head, side jambs and sill together and squaring them up. The two stops shown by letters "G" and "H" are to be nailed onto frame if you use lath and plaster and have outside casing overlap siding. Otherwise, they can be used for braces to keep frame squared up.

In nailing up frame, a very important thing to remember is never to nail two pieces of the frame together so they make a flush joint unless covered with a stop. Note how the casings are set back on jamb on Detail No. 202.

Door Frames—

Figs. 203 and 204 show door frames.

Fig. 203 shows detail of outside door frame with ⅞ inch jamb.

Letter "A" shows outside wall sheathing.
Letter "B," outside casings.
Letter "C," siding stop which is to be left out in case you wish to trim one end of siding.
Letter "D" shows plaster stop, not to be used with plaster board.
Letter "E," jambs.
Letter "F," door stop.
Letter "G," casings,
Letter "H," plaster.
Letter "I," finish floor.
Letter "J," sill.
Letter "K," sub-floor.

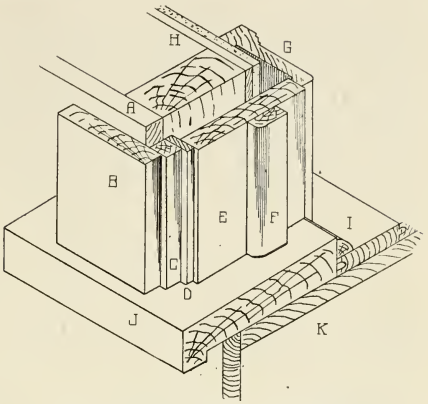


Fig. 203—Outside door frames, 7/8 inch jamb.

Fig. 204 shows detail of outside door frames with 1¾ in. jamb.
Letter "A" shows outside casing.
Letter "B," siding stop which is to be left out if you trim siding.
Letter "C," plaster stop not to be used with plaster board.
Letter "D," jambs.
Letter "E," finishing flooring.
Letter "F," lath and plaster.
Letter "G," inside casing.
Letter "H," sill.

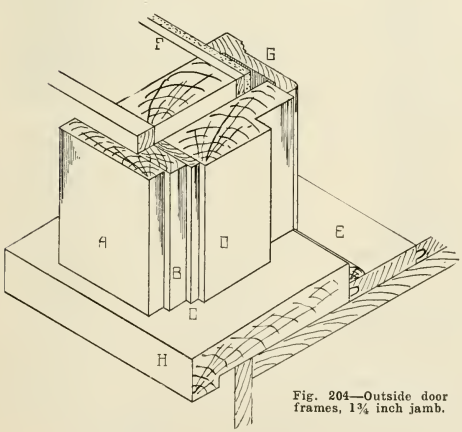


Fig. 204—Outside door frames, 1¾ inch jamb.

Two different outside door frames are furnished with our houses, one with 7/8 in. jamb and fitted with door stop as shown by Fig. 203, and the other frame with a heavy rabetted jamb as shown by Fig. 204. This heavy frame is furnished for large front doors 3x7 ft. in size, and sometimes on smaller doors if they are fitted with heavy plate glass..

To nail the door frames together, first pick out the inside trim and tie together, and mark for it the door on which it is to be used, and put it in a clean, dry place.

Then nail jambs and sill together, squaring them up and nailing on braces. Next nail on stops and outside casings, head casing and drip cap.

In setting the frames in the openings, be sure they are set plumb and square. It is impossible to have window sash on a door work properly in a frame that is not true. Keep the under side of sills and top of head casings in line as much as possible, so the siding will work out the same all the way around the house. Flash casings of window and door frames with building paper as they are being set in the openings, and let this paper extend out far enough to counterflash with paper under siding.

Siding

In order to give the building a neat appearance on the outside, the exterior of the frame buildings is usually covered with one of the many patterns of siding. The patterns furnished with Aladdin buildings are Bevel 5½ in. Siding; Bevel 3½ in. Siding, 8 in. Bungalow, and Novelty Standard pattern No. 106 or No. 105.

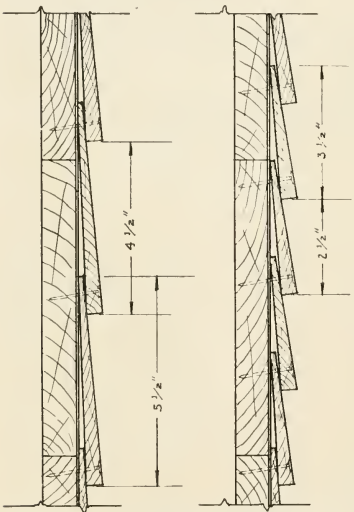


Fig. 205—Shows method of laying and nailing bevel siding.

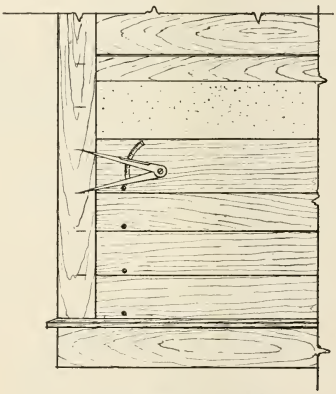


Fig. 206—Method of spacing siding.

When 5½ in. Bevel Siding is furnished, it is intended to be laid 4½ in. to the weather, that is, one piece will overlap the other 1 in. When 3½ in. siding is furnished, it is intended to be laid 2½ in. to the weather, which also gives a lap of 1 in. Fig. 205 cross section thru sheathing and siding showing method of overlapping and nailing.

It is very essential to begin with, that the building paper is put on smoothly; if you are not careful it is apt to bulge between the sheathing and siding, and the wall when finished will have a wavy appearance. This will probably not be noticeable until after the building is painted, but is detrimental to its appearance and should be avoided as much as possible.

In putting on the siding it makes a much better appearing job if you

will lay the siding so that it will just come underneath the window sill and over top of drip cap and windows. See Fig. 206. In order to do this, measure the distance from top of water table cap to top of groove in under side of window sill. For example: Suppose this distance were 2 ft. 3¾ in., six pieces of siding laid 4½ in. to weather would only cover 2 ft. 3 in.: therefore, if you would lay the siding with ⅞ in. lap or 4⅝ in. to weather, it would take up this extra ¾ of an inch and make a much nicer job.

When one side has been sided up, square around the corner boards with tri-square so that the rows of siding will line up around building.

A good deal of time can be saved and lost motion eliminated by using the proper methods. The usual charge for putting on siding is about $16.00 per M. The writer has superintended work where it has been put on for $3.00 per M, simply by watching the unnecessary steps and moves of the carpenters.

For instance, putting on siding between a window casing and corner board, the average carpenter working by the hour will take a piece of siding, put it up between casing and corner board and mark it, pick up his tri-square and square it; then he will lay his square down, pick up his hammer, put piece of siding in place, take out a nail, drive it into siding, take out nail set and set nail, put away nail set and take out another nail. This may sound exaggerated, but you will find many carpenters who will do it when working by the hour. Instead, use a little system while cutting one piece, and cut all that is needed for that length 12-15 or more, whichever it happens to be, then put pieces of siding in place and just put enough nails to each piece to hold it, now start in driving the sufficient number of nails into each board; take out nail set and set heads all at one time. By doing this a man will become efficient in each operation and eliminate a great deal of lost motion.

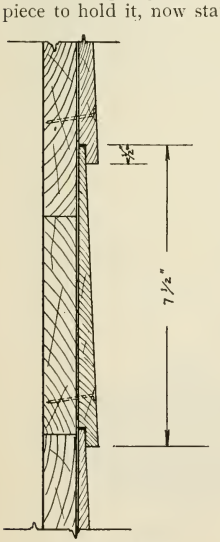


Fig. 207—8 inch Bungalow siding, shiplap pattern.

Three or four gauges can be made out of an old yard stick by cutting it into lengths of about 6 in. and putting a couple of sharp brads into each piece, letting them extend thru about 3/16 of an inch. In using these gauges, though, it would be a good policy to put a chalk line on about every fifth or sixth row of siding to be sure that the rows are all lining up. Be very careful to make good joint on each piece of siding.

Fig. 207 shows 8 in. bungalow siding laid over walls—notice that nailing is to be just above groove in lower end of siding. The lap on this pattern is always the same as the tongue, and groove should always fit tightly. The pieces of siding will have to be notched out around window and door frames if they do not space evenly.

Fig. 208 shows standard patterns of Novelty or Drop siding commonly used on barns, summer cottages and garages. In putting on these patterns, be sure that the pieces are driven tightly together so the joints will not open up.

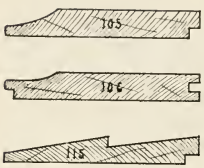


Fig. 208—Standard patterns of drop or novelty siding.

All siding should be carefully butted, and for best work the ends should be dipped into white lead and oil, and should lap over a stud where possible. This will give a good bearing for the end nailing.

The 5 "D" box nails are furnished for siding. It requires about 15 lbs. for each thousand feet of 3½ in. siding, and about 12 lbs. for each thousand feet of 5½ in. The nails should be placed in the center of the lap and close enough together to bring each piece of siding tightly down on the piece which it overlaps. Redwood or cedar siding does not split easily, but should be nailed carefully and the nails directed almost straight in. Pound your nail heads up to the siding and then use nail set. Do not have three or four hammer dents around each nail.

Shingle Side Walls

Until of late clapboards or siding appear to have been considered the only suitable covering for walls of frame buildings of any pretensions. With the coming of the modern houses, however, shingles came rapidly into favor for covering the walls of buildings.

The choice of shingles or siding for wall covering is generally determined by the architectural design. Some designs give a pleasing appearance with walls entirely covered with shingles; others are semi-fitted in design by using siding first story and shingles for second story covering, or shingled gables often help to break the sameness of wall coverings. As a rule, it costs a little more to shingle the side walls of a building than it does to put on siding, but the difference usually is not a big item.

Walls covered with shingles undoubtedly offer greater resistance to heat and cold than do those covered with clapboards, because when shingles are used there are usually three thicknesses at all points, while where siding is used there is but one.

Another reason, aside from the requirements of design, why shingles have been so much in favor as a covering for dwelling houses, is that they are particularly adapted to the absorption of oil or creosote stains, by means of which texture effects are produced to give a pleasing appearance not possible with siding.

The kinds of shingles used for wall covering are the same as those used for roofs. The manner of applying shingles to a wall is the same as that used for roofs, but a greater exposure of butt is permissible, as wall shingles

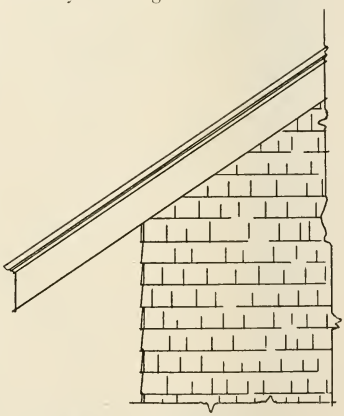


Fig. 209—Method of finishing corners of building with shingles.

are generally laid with an exposure of from 5 to 6 inches to the weather. We have furnished our shingles figured to lay 5 inches, but the exposure to the weather should be altered so that the courses will come out evenly under and over window and door frames. For example: If the distance from the under side of the window sill to the top of the drip cap is 5 ft. 9 in. or 69 inches, divide this space equally, which will give you fourteen 4-15 16 in. spaces. This slight difference in the butt will not be noticeable. In starting to lay shingles on the walls, the first row should be double coursed above the water table (or if water table is not used at the bottom of the wall.) In furnishing external angles the shingles are usually lapped over each other alternately as shown by Fig. 209.

Dormers

Many different types of dormers are constructed on frame dwelling houses. Some are constructed to add to the appearance of the building by breaking the long spans of plain roof, and others are used to give additional head room and light in buildings of bungalow type and those with 1½ story height side walls.

The style of dormer should always be constructed so that it will be in keeping with the general appearance of the main roof. Its size should be governed by the area of which it is a part.

Fig. 210—Shed or split roof dormer.

Three styles of dormers are commonly used on Aladdin houses. First, the split roof or shed roof dormer which is illustrated by Fig. 210. This type is generally used to add to the appearance of the building and is of blind construction; that is, the dormer is constructed upon the sheathing of the main roof, no opening being framed, and the light or head room of dormer is not used. This type is also used to give additional space to second floor or attic of building, in which case the main roof is framed to form opening and making additional room in dormer accessable to balance of second floor.

Fig. 211—Hip roof dormer.

Fig. 212—Gable roof dormer.

Fig. 211 shows a hip roof dormer typical on buildings constructed with

hip roofs. This type also has two functions, namely: ornamental (of blind construction) and to add head room to second story.

The third type is gable roof and is shown by Fig. 212.

All the material for the dormers is marked "Dormer" in addition to other markings; that is, material is marked "Dormer Studding," "Dormer Sheathing," etc. Detail drawings of construction are furnished with blue prints which also show location of dormer on building.

All dormers should be carefully flashed to the main roof with tin flashing furnished for that purpose, so they will not leak.

Porches

THE building of the porch involves two kinds of work, the rough work which supports the floor and roof, and the finished work, which is the part exposed to the eye. Care should be taken to see that the work on the porch of your building is neatly done, as this part of the building is seen first and last by the critic.

There are a number of different style porches furnished with Aladdin houses, and it will be necessary to give instructions on the erection of each different kind, but in erecting your house, only refer to the style indicated on blue prints. The different kinds of porches can also be distinguished by a style letter. On the blue prints each porch will be marked style "A" or style "C." Each descriptive paragraph will also be marked with a style letter.

The construction of the porch joists and supporting piers on all porches is practically the same. The roofs designate the difference in type.

Porches are built and finished in so many different ways, that it is impossible in a book of this size to consider more than a few of the types most commonly in use on Aladdin houses. The blue prints furnished will explain in detail all the construction features and materials to be used.

Porch Piers, Joists and Flooring

By referring to paragraph on Piers, you will find general information on the construction of porch piers, cost and the quantity of material needed. By referring to blue prints you will notice that porch piers are constructed to give a fall to the porch floor, which will allow the water to run off readily. The piers should be placed exactly as shown on plans, and footings carried well below front line and rest on solid rail. If the porch is constructed with masonry pedestals, that is, the piers extend up above the porch floor, they should be constructed up to line shown on under side of joists, then the joists framed in to the pier.

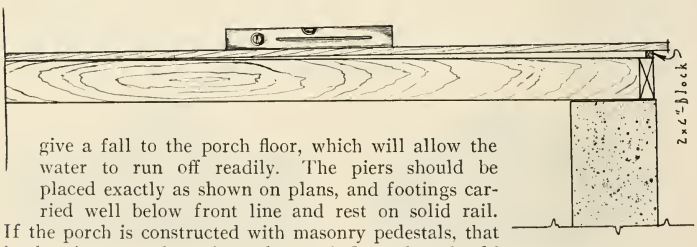


Fig. 213—Method of giving proper incline to porch joist.

After the piers have been constructed, refer to porch joist plan. This

construction should be framed with the joists parallel with the walls of the house, so that the floor boards will be at right angles to these walls and pitch outward. One to two inches in from 6 to 8 ft. will be sufficient to shed the water. The top of the porch joist frame should also be constructed so it will come 2 in. below the top of the house joists. Fig. 213 shows method of using level and block to give proper pitch to porch joists. Fig. 214 shows isometric view of connection of house and porch frame. 16 "D" nails should be used for the porch joist frame.

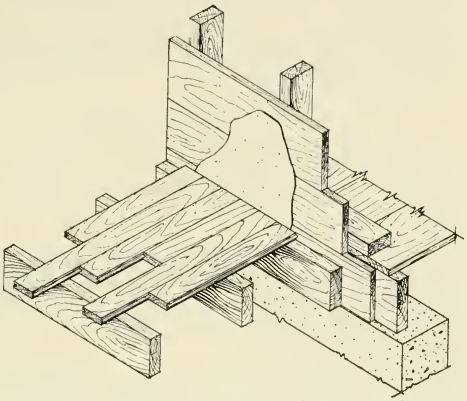


Fig. 214—Isometric view of connection of house and porch frame.

The correct length of porch flooring is shown over porch joist plan. When laying the porch flooring, commence to lay it, placing the first piece about 1¼ inches in from end of joist frame. In other words, leave the first piece off until after the porch is completed so that it will not be broken or cracked by some heavy timber falling on it, etc. Be sure to drive each piece of flooring tightly against the preceding one and securely "toe-nail" it. It is a good plan to paint the joints while the flooring is being laid as this will keep it from warping. The porch floor should be given its priming coat of paint as soon as possible after it is laid.

If the porch is furnished with solid porch rail, the construction of the frame around porch and arrangement of sheathing and outside finish will be shown on the same sheet of blue prints as the rest of porch. After the joists have been erected, nail in place the frame of the porch rail, then nail on sheathing and outside finish and ceil up on inside above porch floor.

In most cases the porch joists and porch overhead joists are to be nailed on over the sheathing of the building, but on some houses when the main roof covers the porch, such as Kentucky, Marsden, etc., the porch frame at the top will be a continuation of the frame of the main building, in which case the porch joists will have to be constructed against the frame of the building. A note on blue prints will tell you if porch joists are to be nailed against frame work or sheathing, and the sheathing will be shown between the porch joists and house joists if so constructed.

Porch Roof Covering

If the porch roof has sufficient pitch it will be covered with shingles or the same material as on the main roof of the building, in which case the roof

sheathing will be 1x4 in. spaced 2 in. apart to allow air to get under shingles and dry them out after heavy rains. (See paragraph on shingling.) Unless otherwise specified on blue prints the porch roof covering will be shingles.

On low pitch roofs we furnish roofing paper, and the porch roof sheathing in this case should be laid tight with no spacing between. (See paragraph on roofing.) A note on blue prints will tell if the roof covering is to be of roofing.

On extremely flat roofs such as are used on pergolas and deck roofs, we furnish rex canvas. Deck roofing instructions for applying are furnished in the Hardware Chapter.

Porch Style "A"

This style is of very simple construction and is furnished on some of the smaller and cheaper designs. Fig. 215 shows an isometric view of the construction of the roof. This frame, you will notice, is constructed out of 2x4x8 and 2x4 inch pieces of material. The different lengths are shown on blue prints, and material is marked "Porch Overhead Joists." The frame is constructed a few inches smaller than the joist frame if tapering columns are furnished. The porch columns should be raised in position and held in place by temporary supports and the frame constructed on top of them.

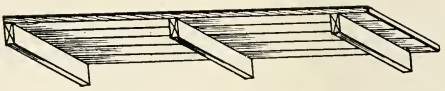


Fig. 215—Isometric detail Porch Style "A."

To cover the porch overhead joists, porch roof flooring has been furnished which is to be laid in the same manner as the porch floor; that is, by painting the joints, and toe-nailing one piece against the other. Carefully study the detail of end and section of porch and read all notes on same.

Porch Style "B"

This style of porch roof construction is used in buildings where a low pitch, neat appearing porch is desired. Fig. 216 shows an isometric view of the construction of the porch overhead joists, all material for which has been marked "Porch Overhead Joists" and the different sizes and lengths of material to use.

The porch overhead joists of porch Style "B" are usually shown on the same figure as the ceiling joists of the house, and should be nailed against the sheathing of the building in the same manner as porch joists.

Fig. 216—Isometric detail porch Style "B."

The porch overhead joists are constructed of pieces of different size as shown on blue prints, so that when nailed together they will give a fall to porch roof. Carefully study isometric detail of section of porch. You will notice that the under side of all the pieces of 2x4, 2x6 and 2x8's are to be on

a level so that the porch ceiling can be nailed to them. The top of these pieces will come so as to give an equal bearing to the roof sheathing. The frame should be held in place with temporary supports until it has been boxed in and you are ready to set porch columns.

The next step will be to nail on the porch roof sheathing, which is usually furnished in 1x8 in. widths, and should be nailed with two nails at each bearing on the frame. The projection of the sheathing is usually 4 in. at the sides and 8 in. at the front. Next, ceil up underneath the porch overhead joists with material marked "Porch Ceiling," toe-nailing each piece at all bearings. Be careful to drive the joints tightly together. The material to be used to box in the eaves is marked "Porch Eaves," and the material to be used to finish around porch overhead joists is marked "Porch Overhead Boxing." Nail these pieces of finish in place. All joints should be made so they are not exposed to the weather, and the various pieces neatly jointed and well nailed together. Then nail moldings in place, set columns and cover roof with roofing. (See paragraph on roofing.)

Porch Style "C"

Fig. 217 shows isometric section of a hip roof porch with a straight return boxed eave. The first figure on blue prints for this style of porch is the porch overhead joists or the frame which is constructed at the top of porch to support the roof. This frame is usually constructed out of a double set of 2 in. pieces of material, the size and length of which are indicated on blue prints. Nail this frame together and put in place at the top of porch, supporting the outer ends with temporary supports until the frame has been boxed in and you are ready to set the columns in place. The other end of frame is to be nailed to the sheathing of the wall of building, against which the porch is to be erected. If the porch joists are entirely roofed over, be sure that the center of this frame is placed in the center of the porch joists. This is absolutely necessary in order to have the columns set properly; then refer to porch ceiling joists which are shown by next figure on blue prints. These ceiling joists are for the purpose of supporting the lower ends of the porch rafters and also to nail the porch ceiling to. Be sure to have these spaced exactly as shown on detail. A chalk line should be placed on outer ends so they will all be set in line. Then take all material marked "Porch Rafters" and erect in the following order: Ridge, main rafters, hip rafters and jack rafters. Securely nail the rafters to the ceiling joists and to each other.

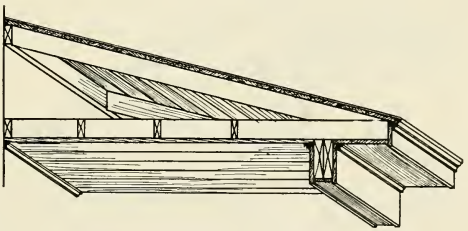


Fig. 217—Isometric detail porch Style "C."

Now refer to detail of mitered porch roof sheathing and sheathe over the rafters with lengths shown in order. If shingles are furnished for porch roof, the sheathing will be spaced same as main roof to allow air to get under shingles and dry them out after heavy rains. When roofing is furnished the sheathing will be laid solid.

Then take material marked "Porch Ceiling" and ceil up underneath the porch ceiling joists, toe-nailing each piece to all bearings, and be careful to drive the joints tightly together.

The material to be used to box in the porch eaves is marked "Porch Eaves," and the material to be used to finish around porch overhead joists is marked "Porch Overhead Boxing." Nail these pieces of finish in place; all joints should be made so they are not exposed to the weather, and the various pieces neatly jointed and nailed together. Then nail moldings in place, set columns and cover roof. Refer to shingle paragraph or instructions on roofing.

Porch Style "D"

Fig. 218 shows a gable roof type of porch which is constructed with boxed or exposed eaves, according to the style of house. The first figure on blue print details shows the construction of the porch overhead joists or the frame which is constructed at the top of the porch for the purpose of supporting the porch rafters. This frame is usually constructed out of a double set of 2 inch pieces of material, the size and length of which are indicated on blue prints. Nail this frame together and put in place at top of porch, supporting the outer ends with temporary supports, until the frame has been boxed in and you are ready to set the porch columns in place. The other end of the frame is to be nailed to the sheathing of the wall of the building, against which the porch is to be erected. Be sure to have the frame at top centered over the porch joists. This is absolutely necessary in order to have the columns fit properly.

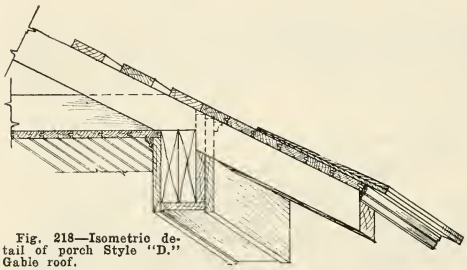


Fig. 218—Isometric detail of porch Style "D." Gable roof.

Next refer to porch ceiling joists which are shown by next figure in blue prints. These ceiling joists are for the purpose of nailing the porch ceiling to. They have been mitered so they will not extend above the porch rafters. Nail them in place spaced as shown on blue prints. Next space off on the porch overhead joist frame, the location of the ends of rafters, and place the same spacings on the porch ridge. Raise the rafters in position on the proper pitch and carefully nail them; then take material marked "Porch Gable Studding" and place studs in the gable or gables and sheathe over with material marked "Porch Gable Sheathing." If the sheathing extends down over frame at front of porch, the sides will have to be furred out so the porch boxing will be the same thickness all the way around the porch. After the gable sheathing has been put on, take material marked "Porch Roof Sheathing" and sheathe over the rafters in the same manner as you did on main roof.

If the eaves of the main building are exposed, the eaves of the porch will be constructed the same. If they are boxed eaves, the porch eaves will be in keeping with them. On exposed eave porches the ceiling to be placed over the

rafter ends and over exposed projection at gable, will be marked "Porch Roof Ceiling," and the lengths to use indicated on blue prints.

If shingles are furnished for porch roof, the sheathing will be spaced same as main roof sheathing so the air can get underneath the shingles and dry them out after heavy rains. When roofing is furnished the sheathing will be laid solid.

Then take material marked "Porch Ceiling" and ceil up underneath the porch ceiling joists, toe-nailing each piece to all bearings, and be careful to drive the joints tightly together.

If the porch has boxed eaves, the material to be used for this purpose is marked "Porch Eaves," and the material to be used to finish around porch overhead joists is marked "Porch Overhead Boxing." Nail these pieces of finish in place. All joints should be made so they are not exposed to the weather and the various pieces neatly jointed and nailed together; then nail in place small moldings, set columns and cover roof. (Refer to shingle paragraph or instructions on roofing.)

Porch Style "E"

Deck roof porches similar to the side porches on Pasadena, Strathmore, Lamberton and front porch of Roseland, are constructed to give pergola effect, but are also roofed over to give protection. The frame for the top of these porches is constructed of fancy end rafters framed together and supported by columns. These rafters are covered with matched ceiling or flooring so as to make a tight roof and give the porch a neat appearance from underneath. In nailing on this ceiling or flooring, be sure to drive the joints tightly together and toe-nail each piece at all bearings. This roof material is then covered with a canvas deck roofing. (See instructions for applying rex canvas deck roofing.)

Porch Rail Balusters and Steps

The standard steps furnished for Aladdin houses are for 2 ft. 0 in. and 2 ft. 8 in. grades. If your building is constructed with a grade different from these, it should have been specified in order, so steps could be made accordingly. The material for steps is all bundled together and marked with the size. They are constructed with wood stringers, the number of which will depend on the width of steps. The stringers should be squared in place and resting on a foundation at the lower end. The best way is to run side walls under steps far enough to support stringers. Next nail the risers and treads in place. The treads are constructed in two pieces which are to be nailed in place with about ¼ inch between; this will allow water to run thru and treads will not warp. The treads are rounded to form a nosing on the front edge and ends, and a cove molding is usually placed under the nosing. The nail heads should be set and well puttied.

The porch rail furnished is molded out of 2x4's and 2x6's in. and the pieces are intended to be nailed between porch columns with the bottom member placed just above base of column, and the top member gauged in place by the length of balusters. The balusters are furnished 1⅜ in. square for 2x4 rails, and 1¾ in. square for 2x6 in. rails, and are intended to be placed on 6 in. centers or two to each running foot. It is a good plan to divide the pieces of porch rail off into as many equal spaces as near 6 in. as possible: this will do away with unequal spacing at end of rail.

Plaster Board

ALADDIN plaster board is not a new material, for it has been manufactured for many years, and the fact that it is rapidly taking the place of wood lath and plaster, is proof enough that it is what we claim it to be, an improved fireproof lathing material. It is a composition of alternate layers of calcined gypsum and strong felt and comes in sheets 32x36 inches, one-quarter of an inch in thickness. Each sheet has a surface of 8 square feet. It will fit studs placed on 16 inch or 18 inch centers. It is practically fireproof and a non-conductor of heat, cold and sound, and can be applied in a quick and easy manner.

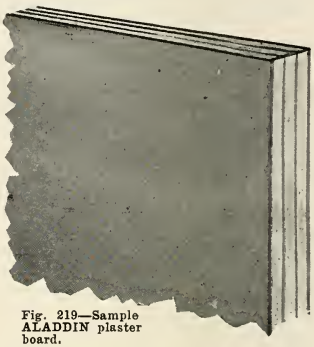


Fig. 219—Sample ALADDIN plaster board.

The most important factor in the application of this material is the framing to which it is applied. Rigid and level studding and joists, headers and all additional framing members have much to do with the finished job, much more than if lath and plaster were to be used.

The sheets of the plaster board should not be placed less than ¼ inch apart on all sides and each edge must have a bearing on the stud of not less than ¾ inch. Nail the board directly to the studding, furring strips or joists. First nail the center of the board and then the outer edges. The nails should be placed 4 inches apart around the edge of the piece, and 8 to 12 inches apart in the center, with each one driven home firm and light. The joints must be broken horizontally on the walls and at right angles with the ceiling joists. Perpendicular joints on opposite sides of partitions must not be placed on same stud as on first side, but should come on next stud, thus giving more strength to the wall.

Fig. 220—Applying ALADDIN plaster board.

Use 1¼ inch large head galvanized nails for applying the board. It takes about 10 pounds of nails to each thousand feet of plaster board.

When it is necessary to cut the sheets to fit around openings, this can be

done with an ordinary hand saw, but be careful that you do not break the outer fibre surfaces away from plaster.

The joints between the board should be filled with the plasto filler furnished for that purpose. If a putty coat is to be used, do not wet the board before applying the plaster, as the bond between the plaster and the board is perfect, and the plaster will adhere to board readily.

The joints between the board should always be filled and allowed to set before the putty coat is applied. By doing this, a perfect bond is formed between the plaster in the board and the putty coat, which will avoid any cracking at the joints. Fig. 220 shows how the sheets of plaster board are to be placed over studs.

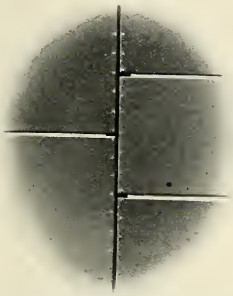


Fig. 221—Note space left between each sheet.

Fig. 222—Plaster board with joints plastered.

The plaster board is usually applied by carpenters, as they can do a careful and efficient nailing job. When plaster board is used in 1½ story buildings and the roof rafters form the ceilings over part of the rooms, we have furnished 1x3 in. furring strips to be placed on 16 in. centers to receive the joints of the sheets of plaster board.

Lath and Plaster

WOOD laths are put up in bundles of fifty laths and should be nailed upon the studding of the wooden frames with a space of about ¼ inch between them. This distance is sufficient to allow for lath shrinkage or swelling, and still provide a firm clinch for the plastering.

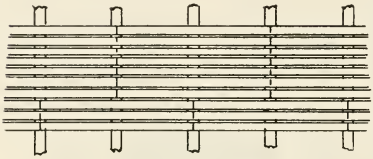


Fig. 223—Applying 32 inch lath.

If the space is made less than ¼ inch, the clinch will be weakened. If much more space is allowed, the laths may possibly sag down on the ceilings with the extra weight of plaster and allow the plaster to run down between them before it has set properly. In no instance, should these spaces between the laths exceed the width of ⅜ inches.

The clinch or key of the plaster is formed by the mortar being pressed thru the spaces between the laths and then spreading out over each of the lath upon both sides of the cracks, so forming a tie or clinch which holds the mortar in place.

Good laths should be only partially seasoned and free from sap and dead knots, or the face of the plaster is liable to be stained from pitchy knot-holes or sap.

If the laths are too dry, the wet mortar is likely to cause them to warp and twist, and if it hardens or sets before the laths become saturated, their swelling is likely to produce cracks. Better results can be obtained by using wet laths; then both mortar and lath will dry out together and make a perfect wall. Remember that wood laths get very thirsty in hot, dry weather and require a lot of water. If this thirst is not quenched beforehand, they will adhere the water that belongs to the gypsum, and prevent its proper setting, frequently causing soft or chalky spots. Wet the lath the night before if convenient or about 4 hours before plastering and give them a chance to soak. Then sprinkle them again about one hour before they are applied.

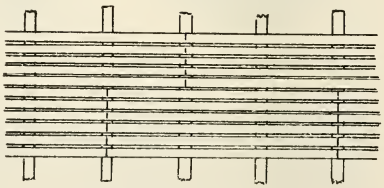


Fig. 224—Applying 48 inch lath.

For the upstairs rooms, or wherever the rooms are open to the rafters, we are furnishing 1x3 in. furring strips to nail on the rafters and collar beams on 16 in. centers to take the joints of the lath.

We have furnished ⅝ in. plaster grounds which are to be placed around all window and door openings and to back up the base molding. These grounds are 1¼ in. wide which will leave ½ inch of stud on which to nail lath around openings. The grounds backing up the base molding are to be placed so as to take the nails from top and bottom of molding. The plaster grounds will also act as a gauge to finished plastered wall. Refer to Fig. 225 which

shows isometric section of finished wall and position of plaster grounds for base molding.

Some specifications call for two nails at each end of lath. Our experience has been that this requirement does not produce the desired results, as two nails are likely to start a split, which may be increased by the force applied to the mortar, and may become partially or wholly loosened from the stub before the plaster is all on. The studs are placed on 16 inch centers; therefore, each 32 inch lath will receive three nails, and 48 inch lath four nails.

Do not use too large a lath nail as this will weaken the wall in same manner. The common 3-penny inch and one-eighth long nail will fasten the lath securely. About six pounds are needed to a thousand 32 inch lath, and about eight pounds to one thousand 48 inch lath.

The joints of the lath should be alternated about every eight courses. This means that not more than eight adjoining lath ends are nailed upon one stud furring strip or joist, the next eight lath in both directions being carried to the next stud. See Fig. 117.

When all the material is furnished by the builder, a lather can be employed to do the work for about 3½c per yard for 32 inch lath and 3c for 48 inch lath, which is the usual charge in this locality.

If the above precautions are followed in lathing, it will aid in securing a good wall.

Plastering

The starting of the interior plastering, marks the division between the "roughing in" work and the beginning of the finish which is to follow.

The plastering should not start until all the lath have been applied and carpenters have stopped pounding on building. Sometimes it will save a considerable amount of time but is not always advisable to set the interior door jambs before the plastering is started. In this case they should be well blocked so that the dampness from plaster will not cause them to warp. The lath and plaster can then be carried up to the jambs, and the projection of the jambs beyond the stud wall will act as a guide to the plasterer for the thickness of coat to be applied. This, of course, will not be necessary if you apply the furring strips which have been furnished with each house.

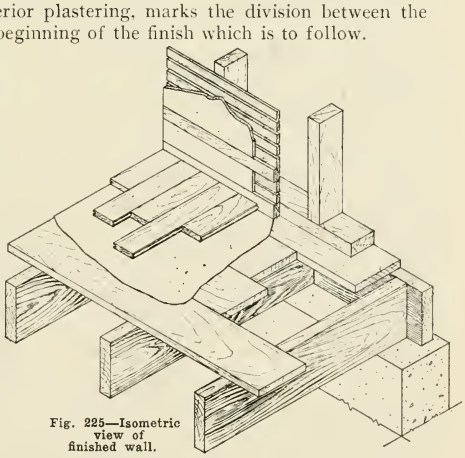


Fig. 225—Isometric view of finished wall.

If this is done, the face of the jambs should be covered with a strip of building paper to keep them clean.

The wood pulp plaster furnished is one of the best grades of plaster on

the market to-day, and when properly applied will give perfect satisfaction as to strength and appearance. It does away with much of the work that is necessary in preparing ordinary lime plaster, as there is no slacking of lime. All that is necessary is to mix water and sand with the plaster until you have it to the proper mixture. The plaster has been figured to be used to the proportion of 2/3 plaster and 1/3 sand, but if an extra good, clean, sharp sand can be obtained it can be mixed down to one part plaster and one part sand. The more plaster and the stiffer the mixture, the harder it is to apply and the faster it will set.

If good, clean sand cannot be obtained, it should be washed so as to free it from impurities. Do not use sand that you can pulverize between your fingers, or sand that soils hands, indicating decaying organic matter. A good way to test sand is to put it in a glass of water; good sand will settle in the bottom of glass leaving water clear.

This plaster is a non-conductor of heat and cold, is absolutely sound and vermin-proof and cannot be damaged by frost, electricity, water or fire. It contains no lime, hair, acid or chemicals.

A large per cent of wood pulp plaster is pulverized stucco rock, which, when dried out becomes very hard and will prevent the plaster from cracking or crumbling. The plaster when properly applied will have a tensile strength of from 200 to 285 pounds.

It can be finished to a rough sand finish or can be trowelled down to a smooth, glossy finish, leaving a good surface for fresco or tinting. It can be applied in any kind of weather, as it does not become affected by the heat or cold and is a good saver of time, as the finish can be applied very soon after plaster has been applied. It will set in about three hours and will become hard in about eight hours in warmer weather.

Do not apply the plaster too thick. It is intended that the lath and one coat of plaster will be $\frac{5}{8}$ of an inch thick. Do not put on too much before trowelling or darbying it down.

A good figure for applying this plaster one coat and finishing to a good surface would be about 7c per yard.

It is well be bear in mind that wood fibre plaster is made from pure rock Gypsum. Rock Gypsum is part water, about 20 per cent. of it. In the manufacturing process, the water is taken out; it is then no longer Rock Gypsum—it is Plaster of Paris. In the mixing and application, water is the chemical force that causes recrystallization, or "setting up." The Plaster of Paris in mortar changes back into Gypsum Rock.

Before applying plaster, all openings should be screened with cloth or other means of preventing blasts of hot air from drying up the water in the plaster. Wood fibre plaster will set, no matter how long it holds if it is kept from drying out before it sets. If it does dry out before it hardens, spray the wall with water or sprinkle liberally with a brush. Give it plenty of water.

Plaster should not dry out before it sets. But don't be alarmed if it doesn't set on schedule time. Keep damp till set. Should it show signs of drying out before setting, spray with clean water. Soft or chalky spots, when dry, mean lack of water. Sprinkle them—give them plenty of water, and the wall will come out sound and hard. If wall dries out or refuses to set, a solution made by adding four or five ounces of zinc sulphate to a pail of water, thoroughly whipped in with a brush, or sprayed, will harden soft or white spots within an hour or two.

If the plaster is applied too thin, the dry lath will quickly absorb the water from the small body of mortar and it will not set until enough water has been thrown on it to thoroughly wet the lath and leave enough to set the plaster.

After plaster has set, open windows or doors and allow free circulation of air to dry out moisture expelled from the plaster. In damp or rainy seasons, provide artificial or other means of drying out the rooms, after plaster has set. This is important.

Our Gypsum plaster is not sent out unless it measures up to a set standard of quality. For this reason, "quick set" or "slow set" is due to local causes. Where hurried or quick action is required, the following remedies may be employed:

Quick set caution: do not confuse "dried out" mortar with "quick set" mortar; distinguish carefully. "Dried out" mortar crumbles between the fingers, while "quick set" mortar feels hard and firm. In case of "quick set," dissolve one pound of pulverized glue in one gallon of hot water. Thoroughly mix the solution into the water that is to be used in mixing the plaster, combining the proportion of one pint of the solution to the water required for each sack of plaster.

If, however, quicker setting is necessary, mix four pounds of alum or two pounds of commercial zinc sulphate to a barrel of water, using from ten to twelve quarts of the solution to the water necessary to mix each bag of plaster, varying this proportion to the amount of plain water used as conditions require.

General Instructions for Mixing and Applying Wood Fibre Plaster

Use only clean water, free from alkali and impurities; keep tools clean.

Do not mix more material than can be handily used in about one hour.

Do not mix one gauging with another, and never retemper plaster after it has commenced to set. Clean the mixing box after each gauging.

Beware of dry lath, they cause much trouble. A good rule is to thoroughly sprinkle the lath the night before, then sprinkle again about one hour before plastering.

Never place plaster on the ground, against a damp wall, or store in damp place. Plaster must be kept dry until used, before setting or crystallizing. Should white or chalky spots appear, sprinkle them with clear water. During summer months all openings in building should be closed to prevent drafts of hot winds from drying out plaster. During the winter months, keep plaster from freezing until thoroughly set. After plaster has set and become hard, allow free circulation of air so it will dry quickly.

Directions For Mixing

Use a clean, tight mixing box about 3½x7 ft. x 12 inches deep. Clean box thoroughly after each mixing and keep it free from dirt and lumps of old plaster. Raise one end of box about 4 inches.

Proportions of Sand

This plaster is unadulterated and should be mixed with four 10-quart buckets of sand to every one hundred pound sack of plaster.

Mixing

Throw in bottom of raised end of box, first a layer of sand and then one of plaster until you have the required amount. Hoe dry from one end of box to the other and back again. Then put water in lower end of box and hoe the mixture into the water and allow it to soak 10 or 15 minutes without hoeing. After this period of soaking, mix thoroughly, adding sufficient water to bring to proper consistency.

The following table will give you the number of yards of plastered walls in each Aladdin house, which will assist you in making and paying plaster and lath contracts.

Table—Shows number of yards of plastered walls in standard Aladdin Houses.

Brentwood	721 yards	Pasadena Plan B	364 yards
Boulevard	434 "	Plaza	517 "
Burbank	411 "	Pomona (1 story)	468 "
Carolina	564 "	Pomona (2 story)	556 "
Charleston	676 "	Princeton No. 1	286 "
Colonial	884 "	Princeton No. 2	334 "
Chester	217 "	Plymouth	322 "
Cadillac	420 "	Raymond	261 "
Duplex	636 "	Rodney No. 1	140 "
Devon	876 "	Rodney No. 2	183 "
Detroit	467 "	Richmond	685 "
Dresden	350 "	Rochester	656 "
Erie No. 1	128 "	Roseland	287 "
Erie No. 2	174 "	Shadow Lawn	673 "
Edison	269 "	Sheridan No. 2	485 "
Franklin	423 "	Sheridan No. 1	422 "
Florence	390 "	Stanhope No. 1	300 "
Finley	378 "	Stanhope No. 2	352 "
Georgia No. 1	383 "	Sheffield	578 "
Georgia No. 2	415 "	Selwyn No. 1	133 "
Gretna Nos. 1 and 2	200 "	Selwyn No. 2	192 "
Herford	441 "	Sunshine	446 "
Hudson	602 "	Strathmore	484 "
Kentucky	497 "	Standard	541 "
Lamberton	733 "	Thelma	214 "
Leota	225 "	Tucson	267 "
Michigan	365 "	Virginia	528 "
Maples No. 1	304 "	Venus No. 1	378 "
Maples No. 2	214 "	Venus No. 2	416 "
Merrill	400 "	Warren	350 "
Marsden	547 "	Winthrop	378 "
New Eden	345 "	Yale	463 "
Pasadena Plan A	511 "		

Interior Trim

THE application of interior trim, hanging of doors and erecting stairs are the most important steps in the erection of your building. This work should be done very carefully and by experienced workmen. It should not be started until after the plaster is thoroughly set and dried out. The interior trim should then be sorted out and gone over carefully, to be sure that it is dry before applying. All raised grains or defects in trim due to careless handling and improper storage should be planed and sanded down smoothly. The manner in which interior finish is put on or fixed in place, varies with the quality of work desired and greatly affects the appearance of the finish, particularly when this is in its natural color.

In ordinary jointers' work, the different parts of finish are nailed to the walls or grounds and to the edge of the frames with finish nails which are sunk beneath the surface of the wood for puttying to conceal the nail holes as much as possible, for they cannot be entirely concealed by the putty even when finish is painted; the nails should be driven into the quirks of moldings wherever practical. Hardwood finish, if nailed, should be bored for the nails in order to prevent splitting of the wood.

Hanging Sash

It is a good plan after the building is thoroughly dried out to hang the window sash and outside doors, so that the building can be closed up and kept dry. First look over the sash to see that the putty is still intact and that the glass does not rattle. The sash when manufactured are made from ¼ to ½ inch larger, so they can be trimmed to fit any variation in the size of the frame. They should be trimmed so they do not bind in frame, but should not be planed down too much, or the sash will rattle. The pieces forming the top and bottom of the sash are called rails, and the side pieces stiles; the small bars dividing the sash into lights are usually called mutins or the trade name "sash bars" is often used.

The size of the sash or windows is usually indicated by the size of the glass and the number of lights in the sash. Carefully fit the sash in the openings and apply the hardware. (Refer to instructions on application of window hardware.)

Be sure that the sash are equipped with the proper size weights. The following table should be followed in balancing the sash with weights. If the top sash are divided into small lights, one pound should be added to each weight attached to it.

Size of Window Weights to Be Used with Different Size Sash

12x16 glass	2½ lbs. each	30x20 glass	5½ lbs. each
14x20 glass	3 lbs. each	30x28 glass	7 lbs. each
14x28 glass	4 lbs. each	30x36 glass	9 lbs. each
20x28 glass	5 lbs. each	38x27 glass	7 lbs. each
26x16 glass	4 lbs. each	38x28 glass	9 lbs. each
26x24 glass	5 lbs. each	38x36 glass	11 lbs. each
26x28 glass	6 lbs. each		

The casement sash are intended to swing into the building and should be fit to work smoothly into the rabbet of the jambs and sill. Single sash are equipped with one pair of 2½x2½ in. butts and casement lock set; the hinges should be applied so they will carry the weight of the sash. Do not have the sash drag on the sill of frame. The fasteners should be placed so when locked they will force the sash all the way into the rabbet of the frame. Casement windows if constructed in pairs, are equipped with a pair of 2½x2½ in. butts for each sash unless extra large, then three butts should be used on each sash. Be sure that each is applied so that the sash will have a bearing on it: a dead butt is of no value to the sash. The flush bolts should be placed at the top and bottom of the sash that swings into the frame. First, be sure they are fitted so they hold the sash entirely into the rabbet. The strike of the casement lock set is to place in the center of the side rail on the same sash with the flush bolts, and should be set so when the arm of the lock is turned into it, the sash will then be closed tightly.

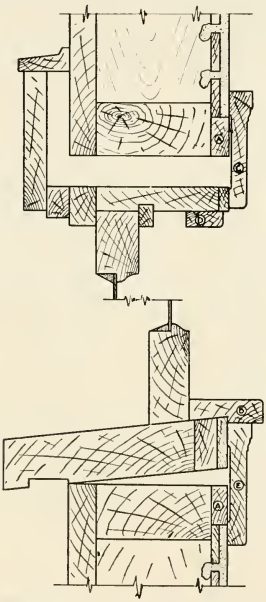


Fig. 226—Detail check rail window frame.

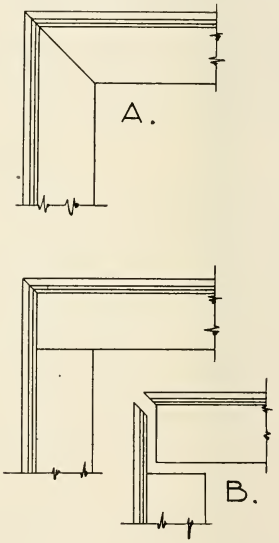


Fig. 228—Detail of miter cuts on casings.

WINDOW TRIM: Carefully study Fig. 226, which shows detail section thru head and sill of a check rail window frame. If lath and plaster has been used on your building, first nail in place the small furring stops on edge of jamb to bring same out flush with plastered wall, also nail small stops on back edge of sill. These stops are indicated by letter "A" of detail. Next, fit in place the stool shown by letter "B;" the stool should be trimmed so that it has a slight projection beyond the two side casings, and the ends should be rounded off the same as the front edge. The casings should then be fitted in place; the intersection of the head and side casings can be

mitered straight across on 45 degrees, or if a better job is desired, they can be fitted as shown by letter "B" of Fig. 228.

This style joint will take more time, but does away with any possibility of the casing opening up at this joint, as is often the case on the straight miter.

In making this joint you will notice that you only miter thru the O. G. back band of the head and side casings. The bodies of the casings are then notched to fit into each other. Nail thru the back band of the side casing into the edge of the head casings: this will hold them firmly together.

In detail 226 you will note that the casing sets back on the plaster stop. If the stop is not used in frame, the casing will be moved forward and is overlapped by the inside stop of the frame. The inside stops should be nailed in place next. It is advisable to miter them at the corners as it makes a better looking job. Letter "E" shows the apron of frame which finishes over the opening left between the sill and plastered wall under window.

Set all nails into the wood and putty them up smoothly.

In the casement frame shown by Fig. 227, first nail in place the plaster stops—Letter "A," if they are to be used. Note that sill is notched out to receive stool shown by Letter "B." The stool in a casement window should be trimmed so it will extend a little beyond the side casing and should be rounded off on the ends same as the front edge. Next fit in place the head and side casings and apron.

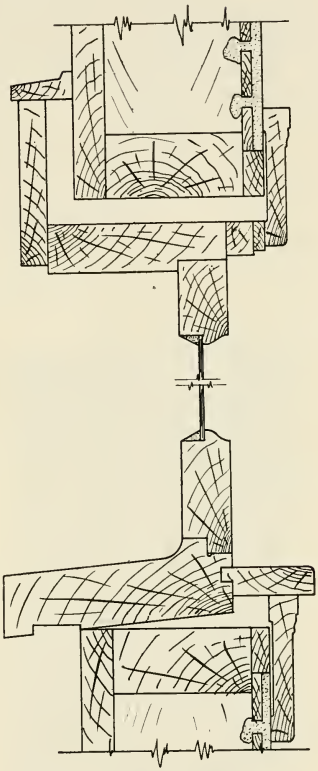


Fig. 227—Detail casement window frame.

Outside Door Frames and Trim

The front and back doors should be hung in place so the building can be closed up to prevent trim being damaged by damp weather. If the building has been furnished with a 3x7 ft. front door, you will find that the jambs of this door frame have been rabetted and are extra heavy. The door should be dressed down to fit opening smoothly and hung on three 4 in. butts. Be sure that each butt is placed so it assists in carrying the door; a dead butt is of no

value. The 2 ft. 8 in. x 6 ft. 8 in. outside doors are hung on one pair of 3½x3½ in. butts. The jambs of this frame are ⅞ in. thick and are finished with ½ in. stops. The outside doors should be painted or stained and varnished as soon as they are hung in place to prevent any dampness working into the wood and destroying the grain or veneer.

Blocks should be nailed between the door jambs and the studding in back of the butts, and also in back of the strike on the opposite side to strengthen the frame.

The casings of the door frames are to set back on the jambs so they will not interfere with the butts. A small piece of flooring should be set under bottom edge of casing, so when floor is laid it will come under it.

Interior Doors and Frames

First take jambs of door frame and nail them together, place a small brace across bottom of frame until it is squared and nailed in opening. In setting jambs in opening, place as near center as possible so the casings will nail into plaster grounds. Place a small piece of flooring under the ends of the side jamb to keep frame ¾ of an inch above subfloor, and the finish flooring can then be worked under frame. Have the frame set perfectly square and nail in place. Small blocks should be placed between the jambs and the studding in back of the place where the strike of the lock and butts will come. The casings and door stops can then be fitted in place, carefully setting all nail heads so they can be puttied up. The door should then be planed down to fit opening and hardware applied. (See instructions on interior door hardware.) The doors can be hung to swing right or left, as they are the same on both sides and the latches in the lock sets are interchangeable. Fig. 230 shows isometric section of door frame.

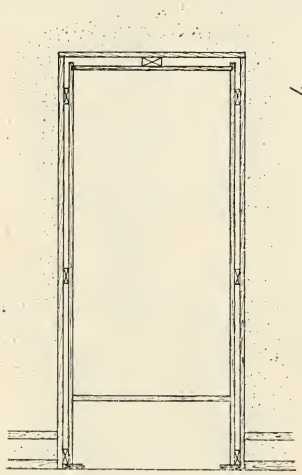


Fig. 229—Method of setting jamb for inside door frame.

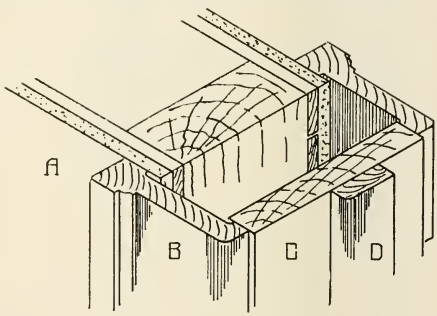


Fig. 230—Interior door frame.

Cased arches are framed in the same manner as door frames, and should be set the same way. Fig. 231 shows isometric detail of cased arch. The jambs of arch frames and door frames are 4⅜ in. for plaster board walls and 5 in. for lath and plaster walls.

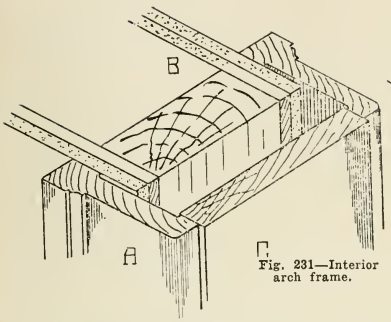


Fig. 231—Interior arch frame.

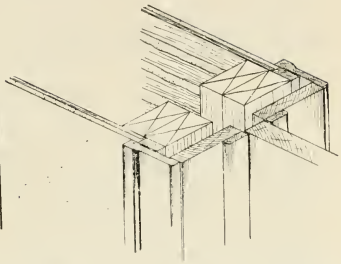


Fig. 232—Isometric detail of sliding door frame.

Frames for sliding doors are constructed in two sections, one to be placed on each side of recess left in partition to admit doors. These frames are fur-

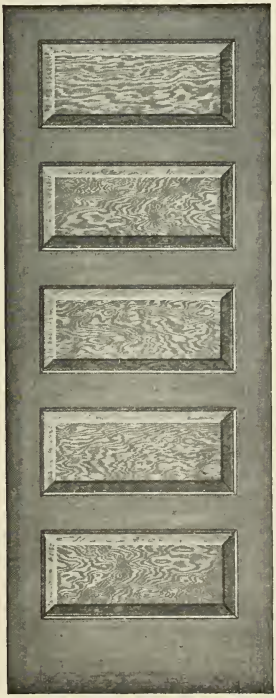


Fig. 233—Standard 5X panel door.

Fig. 234—Standard 2 panel door.

nished with stops to be placed on each side of doors to form finish. Note isometric detail shown by Fig. 232.

Laying Finish Flooring

The first step necessary is to thoroughly clean off the sub-flooring, scrape off all the plaster and be sure you have a smooth foundation to start with. It is intended that the finish flooring be laid opposite to the sub-flooring, as this will make a more even surface to work on.

For between the sub-floors and finish floors we have furnished building paper, which will act as a deadener to sound and also add warmth to the building. Each piece of flooring should be toe-nailed about every 14 or 16 inches and should be brought tightly down to the piece preceding. In making joints, always use a square on ends before nailing in place.

In starting to lay the flooring, it is recommended that a small space be left between the first strip and the studding or wall: this will be covered with the base moulding and base shoe. This space should be left at the ends and opposite side also, so that in case the flooring swells it will have room to spread without crowding the studding or wall and then buckling and spoiling the surface. Care should be taken to see that the first strip is laid straight across the room and that each succeeding one is laid in the same manner. If the flooring is not laid straight, it will throw off the end matching, which is at right angles, and leave an opening between the ends. To make sure you are getting it straight, after three or four courses are laid, one edge of a 4x4 inch piece should be placed against the tongue and the opposite end fit with a sledge. This will force each strip to shoulder up tight against the preceding one, and insure an absolute tight joint and perfect alignment. It should not be forced so tight that it will buckle. The appearance of the floor can be improved if a little care is exercised in not putting together strips that show too great a contrast in color and grain.

The nailing is very important and should be given special attention. The flooring should be nailed at least every 16 inches with 8 case nails. Before the nail is driven home the strip should be "shouldered up" against the preceding one. The nails should be driven in at an angle of about 55 degrees; if the nail is driven too straight, it will split the tongue and will not draw the flooring up, and if driven too slanting it will cause the flooring to buckle. After the nail has been driven almost its entire length, it should be given a final blow with the hammer, to set it and to draw the flooring tightly together. It should not be continually tapped with the hammer after it is driven up, as this will work the nail loose again.

In setting the nail, care should be taken not to bruise the surface or tongue of the flooring, as this will leave an opening between the strips and mar the appearance of the surface. If the tongue is damaged it should be cut off so that it will not prevent the groove of the next piece coming over it tightly.

Hardwood Floors

Hardwood flooring is always end notched and is furnished in much narrower widths than pine. The flooring should be bored for the nails to prevent splitting.

In ordering flooring it is always well to bear in mind that an extra percentage should be ordered to take care of tongue and groove.

On 1⅜ in. face add 47 per cent.
On 2 in. face add 37½ per cent.
On 2¼ in. face add 33 1/3 per cent.
On 3¼ in. face add 25 per cent.

Hardwood flooring should be laid in the same manner as instructed for pine flooring, but usually requires sanding and scraping before applying finish. After all the floors are laid and swept, the scraping can be done by ordinary scrapers, used by cabinet makers, or by one of the many types of hand or power scraping machines that are generally used by carpenters and contractors. The scraping should always be lengthwise of the wood and not across the grain. A floor properly scraped looks very smooth, but to obtain the best results it should be thoroughly gone over with No. 1½ sand paper. After this, the floor should be swept clean and dust removed with rag or soft cloth. The floor is then ready for finish.

Base Molding and Beam Ceiling

Base molding is furnished in widths of 6 and 8 inches and is intended to be nailed to the plaster grounds at the top and bottom. It is furnished with base shoe, which should be nailed on separate. In nailing on the base molding bring it down as tightly as possible to the finish floor, and scribe base shoe down to floor.

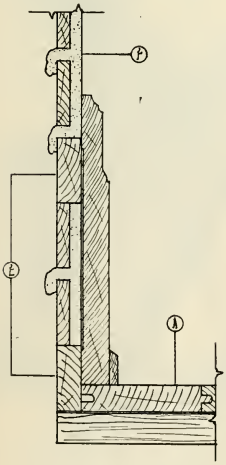


Fig. 235—Base moulding.

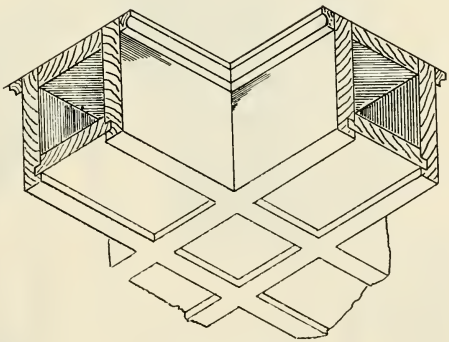


Fig. 236—Beam ceiling.

If it is necessary to splice the base molding, it is always a good plan to miter splice. Refer to Fig. 235 : the finish flooring "A" passes under the base and as near plastered wall as possible.

In some places when the flooring is not level, it is advisable to scribe floor to fit flooring. "F" is the plastering against which the base sets, and "EE" the plaster grounds or furring which are nailed to studs before lath and

plastering is done, so as to provide something against which the base can be nailed.

The base should not, however, be nailed at top and bottom, directly opposite, nail alternately so it will not crack if it should swell. The plastering can be carried down behind the place where the base is to go, or not, as desired. A warmer building can be obtained by plastering down on outside walls, but it is not necessary on inside partitions.

If beam ceilings are furnished for any part of your building, it is always a good plan to place plaster grounds on the joist above the beams, so they will have a solid nailing. Fig. 236 shows isometric detail of beams and location of the different members. Full beams are furnished for center of room and half beams to be placed against the walls.

Stairs

THE stairs are an important feature of a building. On entering the house they are usually the first object to meet the eye and claim attention. A pretty, well balanced stairs surely is an asset to the interior of a home. Many terms are used in stair construction, and it would be a good plan for the reader to make himself familiar with them in order to understand the instructions which follow.

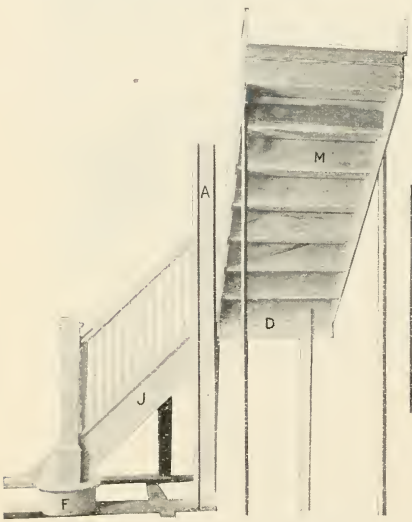


Fig. 238—Back view of standard stairs.

Fig. 237—Front view of standard stairs.

The terms riser and run are often used to indicate the horizontal and vertical dimensions of the stairway, the riser meaning the height from the top of the lower floor to the top of the second floor; and the run meaning the hori-

zontal distance from the face of the first riser to the face of the last or top riser, or, in other words, the distance between the face of the first riser and the point where a plumb line from the face of the top riser would strike the floor. It is, in fact, simply the distance that the treads would make if put side by side and measured together—without, of course, taking in the nosings.

The body of the stairway in this room or space in which the stairway is contained:

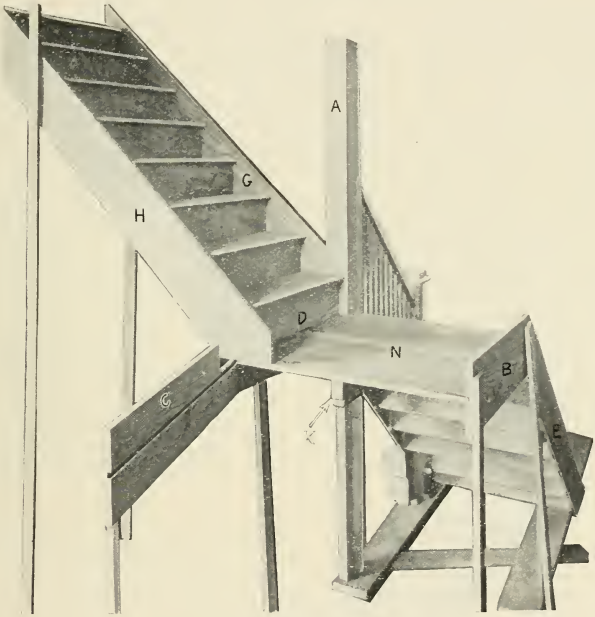


Fig. 239—Side view of standard stairs.

The Tread: This is the horizontal upper surface of the step, upon which the foot is placed. In other words, it is the piece of material which forms the step and is made of a width and length to suit the position for which it is intended.

Riser: This is the vertical height of the step. Its duty is to connect the treads and to give the stairs strength and solidity.

String Board: This is the board forming the side of the stairway, connecting with, and supporting the ends of the steps. Where the steps are housed, or grooved into the boards, it is known by the term housed string, or boxed tread. An open tread is where the stringer is cut out so the treads will set on top of it.

Standard Stairs

The standard stairs of Aladdin houses is a semi-open stairs; that is, the first flight from floor to platform is open, and the second flight from platform to second floor is enclosed by partition walls.

You will find that all the material for the stairs has been crated together and should be kept separate from the rest of the material and put in a dry place until ready to use. The stairs is not to be erected until after the interior walls have thoroughly dried out, and house has been enclosed with sash, and outside doors hung.

Carefully study Figs. 237, 238 and 239 before starting the erection. These photographs show the stairs as you would see it if all the walls were removed.

The first step will be to erect the ¾ post on the end of the partition next to the stairs. This post is constructed of three pieces of ¾ in. finish material, and should case around and form a finish on the end of the partition. It also supports the upper end of the outside stringer of the first run of stairs. Note letter "A." Second step will be to erect the platform; carefully study Fig. 239 and you will see that the pieces marked "B," "C," "D," are grooved out to take the flooring of the platform. Pieces shown by letters "B" and "C" form the stringers and platform, and pieces shown by letter "D" form the first riser of the second flight of stairs. You will also notice a piece of 2 in. material marked "K" bracing the flooring in the center of the platform. To erect the platform first pick out the pieces shown by letters "B," "C," "D," "K," and the flooring for platform; nail this together on the floor of building before raising into position. Drive the pieces of flooring tightly together and toe-nail to the 2 in. brace which comes in the center of the platform. The pieces shown by letters "C" of Fig. 239 and "L" of Fig. 237 are notched out to receive the ends of this 2 in. brace. The flooring will have to be secured into the grooves of pieces shown by letters "B" and "D" by nailing thru these pieces into the ends of the flooring. After the platform has been nailed together it is ready to raise into position.

On the floor plan of your building you will notice that the standard stairs contains 15 risers, seven from first floor up to platform and eight from platform up to second floor. Take a measuring pole and mark off on it the distance from first floor to second floor and divide into 15 equal parts. The seventh mark up from the bottom will be the top of the platform. Put platform in place, nailing temporarily at first until you are sure that it is in the right position. You are now ready to erect the first flight of stairs.

Carefully study Fig. 237 and set in place wall stringer "E." Note that the top of this stringer forms a finish with the top of platform stringer "B." Next, set in place the circle tread "F" and newel post. The outside stringer "J" of first flight sets into the newel, and the ¾ partition post is notched out to receive the upper end. Then nail in place the two wall stringers of the second flight "G" and "H." Note in Fig. 239 that stringer "H" intersects with platform stringer "C" and stringer "G" notched into ¾ post "A."

Then nail in place the risers and treads between the different stringers and note by letter "M" of Fig. 238 that they are held in place in the routing of the stringers by small wedges. Be sure that each riser and tread is square and level, and nail the lower edge of each riser to the back of the treads.

The front edge of each tread is rounded off to form a nosing, and the first

piece of flooring on platform and on second floor should be rounded in the same manner. Cove molding is furnished to form a finish under the nosing of each tread. Next nail in place the molding on the top of the outside stringer of the first flight, and also the hand rail running from newel up to ¾ post "A," and nail the balusters between these members. The top of the stringers is finished with a piece of molding, which, when nailed in place, gives them the same appearance as the base molding; nail these in place and your stairs will be complete.

Standard Attic Stairs

The term "Standard Attic Stairs" is used to designate the stairs which leads from second floor to attic and is usually constructed over the standard first floor stairs. It is a closed stairs and is erected between the partition surrounding the well opening on second floor. All the material has been crated and bundled together and marked "Attic Stairs." You will note by studying detail that this stairs has 12 risers, four from second floor to platform and eight from the platform to attic floor. The platform is constructed out of pieces of 2x6 in. material and is covered with flooring. Nail the platform together and set in place; take a measuring pole and mark off on it the total distance from second floor to attic and then divide into twelve equal spaces. The top of the fourth space will be the top of the platform.

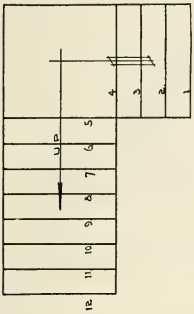


Fig. 240—Standard attic stairs.

Next nail in place the stringers from second floor to platform and from platform to attic, and be sure they are perfectly level and square. Then nail the risers and treads between the stringers, driving the small wedges in place to hold them, and nail the lower end of the risers to the back edge of the treads. The treads have been

Fig. 241—Grade entrance stairs.

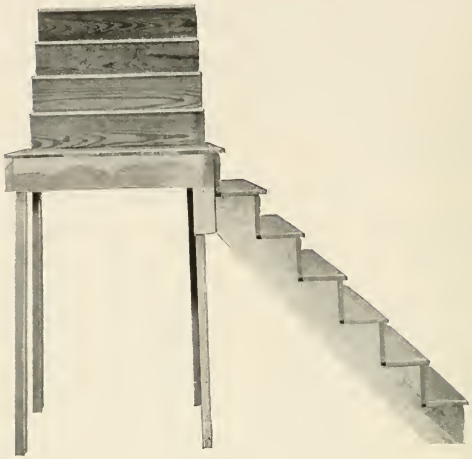


Fig. 242—Grade entrance stairs.

rounded off to form a nosing over the risers, and small moldings have been furnished to finish between the treads and risers.

Standard Grade Entrance Stairs

This stairs is used to enter at grade under standard stairs, with one flight from grade platform to cellar floor and other flight from grade platform to first floor of building.

All the material for the stairs has been crated or bundled together and marked "Grade Entrance Stairs." The standard stairs is intended to be used on a 2 ft. 8 in. grade. Carefully study Figs. 241, 242 and 243.

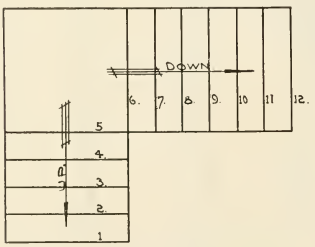


Fig. 243—Standard grade entrance stairs.

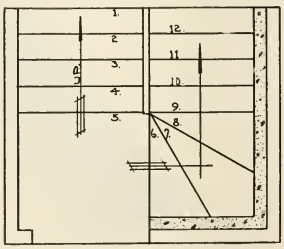


Fig. 244—Standard No. 4 addition grade stairs.

The opening in the wall for the grade door should be 2 ft. 8 in. below the top of wall, and the platform should not flush with opening. The platform is constructed of 2x6 in. material and is covered with flooring. Nail the frame together and floor over, being careful to toe-nail each piece of flooring to all bearings and be sure that each joint is drawn up tightly into the ing to all bearings, and be sure that each joint is drawn up tightly into the preceding piece. The platform, you will notice, on Fig. 242 is supported by placing a 2x4 at each corner; spike these pieces in place and be sure that the platform sets perfectly level. Next nail in place the stringers that go from platform to cellar and from platform to first floor and be sure they are perfectly level and square. Then nail in place the risers and treads. The front edge of the treads is rounded off so as to form a nosing over risers. The first piece of flooring on platform and first floor should be rounded off in the same manner to form a nosing over last risers of first and second flights.

Fig. 244 shows another style of grade entrance stairs, commonly used in the "Style No. 4" addition, and is to be constructed in the same manner as the "Standard Grade Entrance." This stairs is constructed to fit 2 ft. 0 in. and 2 ft. 8 in. grades. You will find all the material for same bundled together and marked "Grade Stairs."

Fig. 245—Packing of Aladdin closette.

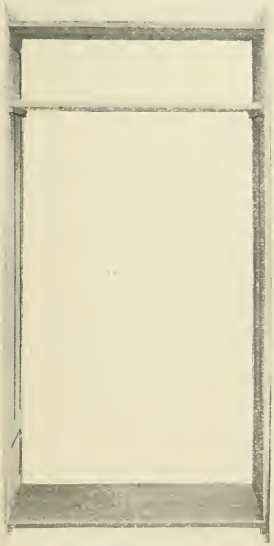


Fig. 246—Nailing closette togtheer.

Aladdin Closette

THE material for Aladdin closettes is all crated and bundled together in one package as shown by Fig. 245. To assemble the closette refer to Fig. 246, which shows the two side panels attached to the top and bottom and the parting shelf nailed in place. When this much of the frame is nailed together, square it up and nail on a few braces on the front edges of panels, then refer to Fig. 247, which shows the back ceiled over and the frame or casings nailed on front with one door hung in place. Note method of mitering molding around the top of closette.

The casings around the top and bottom are set so that the bottom and top boards form a stop for the doors. Fig. 248 shows closette complete with hardware attached. The hardware is all placed in a small bag and marked "Closette Hardware Set."

Fig. 247—Aladdin closette.

Fig. 248—Aladdin closette complete

Painting

THIS step in building construction is a very important one, but is often neglected because some people do not realize the difference in value and appearance between the proper decorating of the exterior and interior of the building.

It is very important that the building get the proper attention in this matter, as it is absolutely necessary in order to insure the work against the elements to which it is exposed.

The outside of the house is painted either in whole or in part; the interior may be painted, stained and varnished, oiled and varnished or enameled. Some houses have the outside walls partly covered with shingles, which are always stained or painted, but the stain or paint is applied for the purpose of preserving the shingles.

Paints are furnished either in a liquid form ready to use, or a readi-colored lead which has to be thinned out before using.

It is our purpose on this subject, to describe only the best and approved methods. It will be understood and certainly observed in practice, that these methods may be abbreviated by the omission of some details. For instance, it is difficult to get an interior finish sand papered or rubbed between coats, but this is the right practice and will depreciate the value of the building if it is not done.

The methods herein described are not extravagant; they are for fairly good structure, truly economical, and we are not considering temporary buildings, but those that will last for years.

As to making selections that will harmonize, we will not try to do so, as the selections of paint will depend largely upon the locality and the surrounding property.

Readi-colored Lead

The readi-colored lead which is furnished by us, is ground in pure raw linseed oil, to the consistency of white lead. It is durable, economical and practical and is one of the best paint pigments made in a lead or paste form.

The surface to be painted must be clean, dry and free from grease, dust or dirt. All the knots and pitchy spots or places containing sap if any, should be well shellaced in order to prevent the heat and elements of the air from drawing them out over the surface of the paint.

In mixing the lead into a liquid form, use a large keg or can so that enough paint for one coat can be mixed at one time. This will enable you to have the different coats placed over the wall uniformly.

In mixing or breaking up the paint, use a flat paddle, as large as can be handled easily. Paint cannot be thoroughly stirred with a round stick; neither can it be mixed thoroughly with a round motion. It must be stirred from the bottom up in order to thoroughly combine the oil and lead.

The oil or thinner should be added gradually to insure a smooth and uniform result in the mixture. If all the thinner is placed in the lead at one time, it will become lumpy and will necessitate straining before using.

It is a very good plan to mix the lead a day or so before it is to be used, as this will allow all the materials to become thoroughly mixed. After it is

mixed, keep the keg well covered so that a skin will not form over the top.

Do not apply the paint too thick, as it will not adhere to the wood as it should, and then will peel off in a very short time.

The various surfaces to be covered, differ as to the amount of paint they will take, as some woods will take up more than others; but under ordinary circumstances 12½ pounds of lead mixed to the proportion given below will cover three hundred square feet, or about 4 pounds to a square, for two coats.

The following will tell how to figure the amount needed, using for example a building 30x40 feet with an average height of 18 feet:

Front wall	540 feet
Back wall	540 feet
Side walls	1,440 feet
	2,520 feet,
	or about 25 squares.

25x4 equals 100 pounds required to paint a house 30x40 feet, two coats.

For outside work, mix the paint in the following proportions: Priming coat, 100 pounds of lead, 6½ gallons pure boiled linseed oil; Finishing coat, 100 pounds lead, 5 gallons pure boiled linseed oil.

Applying Paint

The first step is to see that the surface to be painted is perfectly clean, free from sand, grease, oil or stain. Then all the knots and pitchy spots should be covered with shellac which prevents the heat and elements of the air from letting the pitch come thru and show upon the surface of the paint. After this is done, apply the first or priming coat.

This coat should be put on very thin, that is, it should be mostly oil, as it is almost all taken up by the wood and will require a great deal more paint than the second coat. The second coat, well brushed out, will cover about twice as much surface as the first. Priming coats are used on both exterior and interior painting.

Each coat should be given sufficient time to dry out thoroughly before the next one is applied. This will take a week or ten days.

Between the priming and the second coat, all the nail heads and cracks should be filled up with putty. Many painters neglect the nail heads, but this is a bad practice, as they will rust and stain the walls.

Do not use the paint too heavy.

Do not use in damp, cold weather, especially on new wood, as it will be damp to some extent and the oil in the paint will not adhere to it as it should.

To get uniform results, the paint must be kept a uniform consistency.

Brushes

A brush which has only a low price to recommend it will prove a poor investment. If properly cared for, brushes will last a long time, and therefore, it pays to have good ones. Inferior brushes contain inferior bristles and will not insure a good job. "A good workman must have good tools."

Paint brushes are made round, flat and oval. The favorite brushes for outside work have bristles about 2½ inches long, oval brushes or round

brushes, 2, that is, large, round brushes with long bristles. These brushes are recommended by the paint committee of the American Society of Testing Materials. A flat brush is heavy and hard to work the paint with. A few round or flat brushes of smaller sizes called "sash tools" are needed for work around trim, window frames and sash. Flat brushes from one to 2½ inches in width are the best to be used for varnishing and interior work.

Brushes should be kept clean and soft and not allowed to become dry with paint or varnish in the bristles. To prevent this, wash them out in oil or turpentine as soon as you are thru using them. If used in shellac, wash out in alcohol, or they may be left in the paint or varnish for a few days, but when you are ready to put them away, wash out thoroughly, first with oil or turpentine and then soap and water.

Fillers

The surface to be stained should be dry, smooth and free from grease, dust or dirt. Apply a thin coat of shellac to all knots, pitchy or sappy places.

This filler is a composition dye and filler. It should be poured out of bottle into can and thoroughly mixed before applying. Stir the contents from the bottom up, with a flat wooden paddle. It is very important that all the pigment in the stain become thoroughly mixed in order to get a uniform dye on wood. Stain if left exposed to the air, has a tendency to become fatty. This makes it work hard under the brush, retards its drying and in some cases causes it to run. To prevent this, the stain not used should be poured back into bottle and cover put on in order to keep air from the stain. This is important, as it prevents oxidation and evaporation, also keeps the stain a uniform consistency. The slip cover fits the bottle snugly.

After the stain has been applied to the wood, it should be rubbed off with a wad of excelsior, a clean cloth, or piece of felt, which will do away with any dust that may have settled upon the stain, and also a part of the pigment in it which stays on top of the wood.

If any thinner is needed in the stain, do not use linseed oil. Add a very little turpentine. The addition of turpentine will lighten the color of the stain.

A free circulation of air is needed in a building in order to have any kind of stain, paint or varnish dry properly.

After the stain has been properly applied and dried out, the shellac, varnish or wax should be put on. The shellac or varnish applied in a cold temperature becomes thick and it cannot be applied easily.

All the nail heads and cracks should be well filled with putty which has been stained the same color as the wood. Do not apply the putty before the wood has been stained.

Flat Finish

The flat finish paints which are furnished by us are very practical and sanitary. They will produce a smooth, velvet, dull surface which can be put on new walls, burlap or walls which have been kalsomined. They are very sanitary as they can be washed with soap and water, and will not become spotted by the water, as they are moisture proof.

Painting Plastered Walls

Old plastered walls may be painted with oil or enameled paints as though they were wood, remembering that the priming coat will have almost all of its oil absorbed by the plaster. Newly plastered walls do not take paint well, on account of the alkaline character which will gradually disappear when exposed to the elements of the atmosphere.

It is well to have a wall remain unpainted at least a year; but if it is necessary to paint a freshly plastered wall, it can be prepared by washing with a solution of sugar in vinegar, the sugar uniting the lime to some extent; or, more commonly, by washing it first with a strong solution of soap. After this is dry, it is washed with clear water, allowed to dry and then painted. The alum and soap form an insolvable compound which closes the pores of the plaster to some extent and prevents the lime from acting on the paint.

Re-painting

If the old paint has been on a long time, it is liable to be permeated by small cracks which admit moisture to the surface of the wood and will loosen the paint. Thus, if you paint over this, the new paint, which shrinks in drying, tends to peel off the old paint, and of course, the whole peels off in places. If the old paint is in this state it should be removed before the new paint is applied. This can be done by burning it off.

For this work, a painter's torch is required, which is a lamp burning alcohol, gasoline, or kerosene, and is so constructed that a blast of flame can be directed against the surface. This melts or softens the old paint and it can be easily scraped off with a steel scraper or wire brush.

SHINGLE STAIN: The shingle stain furnished by us is one of the best brands obtainable. It is made of creosote and other wood-preserving and penetrating oils, and can be used on all shingles or exterior wooden surfaces (rough or smooth). It brings out the grain of the wood in an artistic manner, and for producing a soft, velvet effect, is unequaled.

Some people prefer to dip the shingles into the stain, but this method has not given satisfaction, in that too much time is wasted. We advise that the stain be applied to the shingles with a brush. The shingle stain has been furnished in an oil and coloring form. When mixing be sure to work to a consistent color before applying; try your stain on a few shingles first to be sure that it is the shade you desire. In applying be sure to brush it into and between the shingles, so all the exposed surface of shingles will be colored. It requires about 1 gallon of shingle stain to brush coat 1,000 shingles if carefully applied.

Varnishing

A VARNISH is a liquid made to be applied to a surface in a thin form, which, when exposed to the air, hardens into a protective coating which is usually glossy and almost transparent. It preserves the wood to which it is applied from being affected by the elements of the air. Varnish is made in two forms, shellac and resinous varnish.

The two kinds of shellac are orange, which is the natural shellac color, and white shellac, which is made by bleaching with chlorine. Orange shellac is the better of the two.

Before applying the varnish, the wood should be perfectly dry. For this reason, it is necessary to clean it by sanding. Avoid water on wood as much as possible.

Under proper conditions, it should first receive a filler, if it is an open grained wood. A close grained wood does not need a filler, but a filler is sometimes used. When such is the case, rub it in well so as to get it into the pores of the wood. This rubbing should not be done until the stain has set, say in 15 or 20 minutes after it has been applied. It is a good plan to let it stand a couple of days before the shellac or varnish is put on.

Window sills, jambs, inside stops and other surfaces exposed to the direct rays of the sun and light should be treated as interior woodwork and are to be varnished.

The varnish should be put on in a thin coat, well brushed out and applied with the grain as much as possible. Always apply varnish in a warm temperature, as it will get gummy if put on in cold weather. Do not allow it to dry too quickly. Sufficient time must be given each coat to dry thoroughly. Under ordinary conditions, this will take about one week.

Instructions for Reversing Buildings

MANY of our customers, when purchasing houses, wish to have them furnished so they can be erected reversed, or just the opposite to the original layout. This is often done in order to have the main rooms come on the pleasant side of the street or lot. This change does not require any change in material excepting on stair work. The same bill of material will work out either way.

If possible, we try to retrace the plans so they will be shown reversed, but if this cannot be done we stamp the blue prints so there can be no mistake in erection.

Part IV

Garages, Barns and Summer Cottages

Garages

Introduction

First read over paragraph I, on page 209, pertaining to unloading and care of material, and introductory paragraph on page 209. Paragraph II, on page 211, special note regarding change on blueprints, paragraph on page 212, explanation of blueprints and measurements. Carefully read the paragraphs on page 213.

For the roofing, shingling and painting of garages, the instructions will be the same as those furnished for the house, and by referring to these paragraphs on these subjects, complete information can be obtained.

If windows are furnished with the garage, the details are practically the same as those for houses, with the exception of interior trim. This is not furnished in garage construction.

Instructions for Erection of Buick Garage Size 8x14

Paragraph 1

Explanation of Different Figures on Blueprints

Fig. 1 shows floor plan of building.

Fig. 2 shows construction of 2x4 studding, in right side wall. Note intersection of 2x4 plates at top and bottom.

Fig. 3 shows arrangement of siding and outside finish over Fig. 2.

The Buick.

Fig. 4 shows construction of 2x4 studding in left side wall.

Fig. 5 shows arrangement of siding and outside finish over Fig. 4.

Fig. 6 shows construction of studding in front wall.

Fig. 7 shows arrangement of siding and outside finish over front wall.

Fig. 8 shows construction of studding in back of building.

Fig. 9 shows arrangement of siding and outside finish over back wall.

Fig. 10 shows arrangement of rafters as they are placed over both sides of building; also shows length of 1x4 in. roof sheathing.

The four details show—gable siding, double doors, section thru eave of building at gable and section of eave at side of building.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor bolting the 2x4 sill plates to same.

These 2x4 sill plates are shown at the bottom of Figs. 2, 4, 6 and 8. If the building is to be erected on a cement floor, bolt the 2x4's shown at the bottom of Figs. 2, 4, 6 and 8 to the cement. Then the second 2x4 sill plates can be nailed up with wall, and then the wall nailed to the 2x4 plates fastened to cement floor.

If the garage is to be erected on posts, both sill plates can be nailed up with wall and then spiked to posts.

First refer to Fig. 2 and take two 2x4's 14 ft. 0 in. long and mark off on them the distance showing location of studs as shown by this figure on blueprints. Then nail the 2x4 studs 7 ft. 0 in. long in between them. Nail in place the second set of 2x4's 13 ft. 4½ in. long. (Note this second set drops back 3¾ in. from each end to allow intersection of 2x4's from front and back walls.) Then raise the wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. Then in the same manner erect Figs. 4, 6 and 8, carefully nailing them together at the corners, and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place siding on studding before rafters, as it will strengthen the walls. Two pieces of 2x4's 8 ft. 0 in. long and mitered off at each end so they will not extend above rafters, have been furnished to tie side walls of building together. These have been marked "Collar Beams." Nail them in place at this time.

Next take siding and start putting it on from the bottom of the building; being very careful to drive each piece tight against the one below, and securely nail it so the joints will not open up afterwards. Carefully read paragraph on Siding in Part III.

Paragraph 4

Next refer to Fig. 10, which shows construction of roof plan of building. First space off on top plates of side walls the location of rafters. Then take 1x4 in. pieces of sheathing marked "Ridge" and space off the location of rafters on it. Start at one end of building and commence nailing the rafters on both sides of the roof. Be very careful to see that the ridge is kept level and in line with building. A chalk line should be placed on ends of rafters where they project down on building, and if when all rafters have been erected you find that one does not line up with the rest, saw it off. A few pieces of roof sheathing should be nailed on rafters about in the center so as to help keep them in line. Be sure that the rafters on which the sheathing is to be nailed are placed exactly as shown on blueprints.

Paragraph 5

The next step will be to place the mitered studs in the gables of the building. Place the center stud first and then nail in place the two at each side. You will find this mitered studding marked "Gable Fig. 6" and "Gable Fig. 8."

Then take siding marked "Gable Siding Fig. 7" and "Gable Siding Fig. 9" and side up the gables in the same manner as you did the side walls of building, being careful to nail each piece tight down against the one below it.

Paragraph 6

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond to those on blueprints. When shingles have been furnished to cover roof, the sheathing has been furnished in 1x4 in. widths, and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and a space should cover 6 in. The sheathing is so spaced in order to allow air to get underneath the wood shingles and help in drying them out after they have become soaked by heavy rains. If the roof sheathing is laid tight and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather. When semi-slate shingles, roofing, tin shingles, or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 7

On the blueprints you will find an isometric quarter full sized detail of eaves at sides of building, illustrating boxing in of rafter ends and of eaves that extend out over side walls, showing boxing in of end of roof sheathing that projects out over gables. The material for boxing in the eave has all been marked "Eaves." Take this material and box in the eaves as shown by details. Finishing, eight case or small headed nails should be used for this purpose, so that the heads can be set into the wood and puttied up. Next nail together material for doors and hang doors in place.

Paragraph 8

The next step will be to place on the roof covering. Refer to shingling or roofing paragraph of General Instructions.

Paragraph 9

Last step, paint the building. Refer to Paint Paragraph of General Instructions.

Instructions for the Erection of Buick Garage 10x16

Paragraph 1

Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.

Fig. 2, construction of 2x4 studding in right wall. Note intersection of plates at top and bottom.

Fig. 3. arrangement of siding and outside finish over Fig. 2.

Fig. 4, construction of 2x4 studding in left side wall.

Fig. 5, arrangement of siding and outside finish over Fig. 4.

Fig. 6, construction of studding in front wall, also arrangement of gable studding and position of rafters in gable.

Fig. 7, arrangement of siding and outside finish over front wall.

Fig. 8, construction of studding in back wall.

Fig. 9, arrangement of siding and outside finish over back wall.

Fig. 10, arrangement of rafters as they are placed over both sides of roof, also shows lengths of 1x4 in. roof sheathing.

The four details show gable siding, double doors, section thru eave of building at gable and section of eave at side of building.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor, bolting the 2x4 sill plates to same. These 2x4 sills are shown at the bottom of Figs. 2, 4, 6 and 8. If the building is to be erected on a cement floor, bolt the 2x4's shown at the bottom of Figs. 2, 4, 6 and 8 to the cement, the second 2x4 sill plates can be nailed up with wall, and then the wall nailed to 2x4 plates fastened to cement floor. If the garage is to be erected on posts, both sill plates can be nailed up with wall and then spiked to posts.

First refer to Fig. 2 and take two 2x4's 16 ft. 0 in. long and mark off on them, the distance showing the location of studs as shown by this figure on blue print. Then nail all the 2x4 studs 7 ft. 0 in. long in between them, nail in place the second set of 2x4's 15 ft. 4½ in. long. (Note this second set drops back 3¾ in. from each end to allow intersection of 2x4's from front and back wall.) Now raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. Then in the same manner erect Figs. 4, 6 and 8, carefully nailing them together at the corners, and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place siding on studding before rafters, as it will strengthen the walls. Two pieces of 2x4's 10 ft. 0 in. long and mitered off each end so they will not extend above rafters have been furnished to tie side walls of building together. These have been marked "Collar Beams." Nail them in place at this time.

Next take siding and start putting it on from the bottom of the building, being very careful to drive each piece tight against the one below, and securely nailing it so the joints will not open up afterwards.

Paragraph 4

Now refer to Fig. 10 which shows construction of roof plan of building. First space off on top plates of side walls the location of rafters. Then take 1x4 in. pieces of sheathing marked "Ridge" and space off the location of rafters on it. Start at one end of building and commence erecting the rafters on both sides of the roof. Be very careful to see that the ridge is kept

level, and in line with building. A chalk line should be placed on ends of rafters where they project down on building, and if, when all rafters have been erected, you find one does not line up with the rest, saw it off. A few pieces of roof sheathing should be nailed on rafters about in the center so as to help keep them in line. Be sure that the rafters, on which the sheathing is to break, are placed exactly as shown on blueprints.

Paragraph 5

The next step will be to place the mitered studs in the gables of the building. Place the center stud first and then nail in place the two at each side. You will find this mitered studding marked "Gable Fig. 6" and "Gable Fig. 8."

Then take siding marked "Gable Siding Fig. 7" and "Gable Siding Fig. 9" and side up the gables in the same manner as you did the side walls of building, being careful to nail each piece tight down against the one below it.

Paragraph 6

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond to those shown on blueprints. When shingles have been supplied to cover roof, the sheathing has been furnished in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart; that is, a piece of sheathing and a space should cover 6 in. The sheathing is so spaced in order to allow air to get underneath the wood shingles, and help in drying them out after they have become soaked by heavy rains. If the roof sheathing is laid tight, and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather.

In placing the sheathing over rafters, each run should be alternated as shown on blueprints.

When semi-slate shingles, roofing, tin shingles or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 7

On the blueprints you will find an isometric, quarter full sized detail of eave at sides of building, showing boxing-in of rafter ends, and of eave that extends out over gable illustrating boxing-in of end of roof sheathing that projects out over gables. The material for boxing-in the eave has all been marked "Eaves." Take this material and box in the eaves as shown by detail. Finishing, eight case, or small headed nails should be used for this purpose, so that the heads can be set into the wood and puttied up. Then nail together material for doors and hang the doors in place.

Paragraph 8

The next step will be to place on the roof covering. Refer to roofing or shingling paragraph of General Instructions.

The instructions for painting garages are the same as those furnished for houses. Refer to Par. on Paint.

Instructions for the Erection of the Maxwell Garage 10x16

Paragraph 1

Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.

Fig. 2 shows construction of 2x4 studding in right wall. Note intersection of plates at top and bottom.

Fig. 3 shows arrangement of sheathing and outside finish over Fig. 2.

Fig. 4 shows construction of 2x4 studding in left wall.

Fig. 5 shows arrangement of sheathing and outside finish over Fig. 4.

Fig. 6 shows construction of studding in back wall, also arrangement of gable studding and position of rafters in gable.

Fig. 7 shows arrangement of sheathing and outside finish over back wall.

Fig. 8 shows construction of studding in front wall.

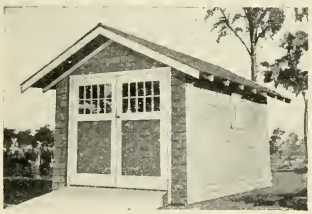
Fig. 9 shows arrangement of sheathing and outside finish over front wall.

Fig. 10 shows arrangement of rafters as they are placed over both sides of roof, also shows length of 1x4 in. roof sheathing and roof ceiling.

The four details show gable sheathing, double doors, section thru eave of building at gable and section of eave at side of building.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor bolting, the 2x4 sill plates to same. These 2x4 sills are shown at the bottom of Figs. 2, 4, 6 and 8. If the building is to be erected on a cement floor, bolt the 2x4's shown at the bottom of Figs. 2, 4, 6 and 8 to the cement, the second 2x4 sill plates can be nailed up with wall, and then the wall nailed to 2x4 plates fastened to cement floor. If the garage is to be erected on posts, both sill plates can be nailed up with wall and then spiked to posts.



The Maxwell.

First refer to Fig. 2 and take two 2x4's 16 ft. 0 in. long and mark off on them, the distance showing the location of studs as illustrated by this figure on blueprint. Then nail all the 2x4 studs 8 ft. 0 in. long, in between them, nail in place the second set of 2x4's 15 ft. 4½ in. long. (Note this second set drops back 3¾ in. from each end to allow intersection of 2x4's from front and back wall). Now raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. Then in the same manner erect Figs. 4, 6 and 8, carefully nailing them together at the corners, and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place sheathing on studding before erecting rafters, as it will strengthen the walls. Two pieces of 2x4's 10 ft. 0 in. long and mi-

tered off at each end so they will not extend above rafters have been furnished to tie side walls of building together. These have been marked "Collar Beams." Nail them in place at this time.

Next take sheathing and start putting it on from bottom of the building, being very careful to drive each piece tight against the one below, and securely nailing it, alternate the lengths as shown on blueprints.

Paragraph 4

Now refer to Fig. 10 showing construction of roof plan of building. First space off on top plates of side walls the location of rafters. Then take 1x4 in. pieces of sheathing marked "Ridge" and space off the location of rafters on them. Start at one end of the building and commence nailing the rafters on both sides of the roof. Be very careful to see that the ridge is kept level and in line with building. A chalk line should be placed on ends of rafters where they project down on building, and if, when all rafters have been erected, you find that one does not line up with the rest, saw it off. A few pieces of roof sheathing should be nailed on rafters about in the center, so as to help keep them in line. Be sure that the rafters on which the sheathing is to break are placed exactly as shown on blueprints.

Paragraph 5

The next step will be to place the mitered studs in the gables of the building. Place the center stud first and then nail in place the two at each side. You will find this mitered studding marked "Gable Fig. 6" and "Gable Fig. 8."

Then take sheathing marked "Gable Sheathing Fig. 7" and "Gable Sheathing Fig. 9," and sheath up the gables in the same manner as you did the side walls of the building, being careful to nail each piece down tight against the one below it.

Paragraph 6

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond to those shown on blueprints. Roof Sheathing has been furnished to go in center of rafters, but over the eaves at gable ends and end of rafters, roof ceiling has been furnished so as to give the eaves a neat appearance. When shingles have been supplied to cover roof, the sheathing has been furnished in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and a space should cover 6 in. The sheathing is so spaced in order to allow air to get underneath the wood shingles, and help in drying them out after they have become soaked by heavy rains. If the roof sheathing is laid tight, and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather.

In placing roof ceiling on rafters be sure to drive each piece down tightly against the one below it, and securely toe-nail it in place.

When semi-slate shingles, roofing, tin shingles or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 7

On the blueprints you will find an isometric, quarter full sized detail of

eave at sides of building showing small cove mold on ends of rafters, and at top of frieze. Take material marked "Outside Finish" and nail in place as shown on Figs. 3, 5, 7 and 9. The pieces of 2x6 furnished to go in gable ends for facia are to be nailed on underside of roof ceiling. The side walls of building are to be shingled in same manner as roof. If siding is furnished instead of shingles it should be nailed in place just after roof has been shingled. Then hang door in place and set sash.

Paragraph 8

The next step will be to place on the roof covering. Refer to roofing and shingling paragraphs. For painting and shingle stain instructions refer to Part III.

Instructions for the Erection of the Winton Garage 12x20

Paragraph 1

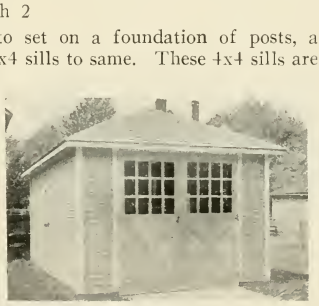
Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.
Fig. 2 shows construction of 4x4 sills.
Fig. 3 shows arrangement and construction of 2x4 studs in right wall.
Fig. 4 shows arrangement of siding and outside finish over Fig. 3.
Fig. 5 shows construction of 2x4 studding in left wall.
Fig. 6 shows arrangement of siding and outside finish over Fig. 5.
Fig. 7 shows construction of studding in front wall.
Fig. 8 shows arrangement of siding and outside finish over front wall.
Fig. 9 shows construction of studding in back wall.
Fig. 10 shows arrangement of siding and outside finish over back wall.
Fig. 11 shows arrangement of rafters as they are placed over both sides of roof. It also shows position of the two 2x4 collar beams or ceiling joists.

The four details show Roof Sheathing, double doors, section thru eave of building and boxing in end of rafter.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor, bolting 4x4 sills to same. These 4x4 sills are shown at the bottom of Figs. 3, 5, 7, 9 and in Fig. 2. If the building is to be erected on a cement floor bolt the 4x4 shown at the bottom of Figs. 3, 5, 7 and 9 to the cement, and erect the walls by toe nailing the studs to the sills.



The Winton.

If the garage is to be erected on posts, the sills can be nailed up with walls and spiked to posts after the walls have been raised.

First refer to Fig. 3 and take 4x4's 20 ft. 0 in., one 2x4 12 ft. 0 in. and one 8 ft. 0 in. long and mark off on them the spaces showing the location of studs in this figure on the blueprints. Then nail all the 2x4 studs 8 ft. 0 in. long in between them, nail in place the second set of 2x4's 12 ft. 0 in. and 7 ft. 4½ in. long. (Note this second set drops back 3¾ in. from each end to

allow intersection of 2x4's from front and back wall.) Now raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. In the same manner erect Figs. 5, 7 and 9, carefully nailing them together at the corners and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place siding on studding before erecting rafters, as it will strengthen the walls. Two pieces of 2x4's 12 ft. 0 in. long and mitered off at each end, so that they will not extend above rafters have been furnished to tie side walls of building together. These have been marked "Collar Beams" or "Ceiling Joists." Nail them in place at this time and be sure that they are placed so that they will not interfere with rafters.

Next take siding and start putting on from the bottom of the building, being very careful to drive each piece tight against the one below and securely nailing it so that joints will not open up afterwards. Use 5d common nails for the Siding.

Paragraph 4

Now refer to Fig. 11 which shows construction of rafter plan of building. First space off on top plates of side walls, the location of the seat of rafters. Then take 2x4 pieces marked "Ridge" and space off the location of rafters on both sides, and place at each end a pair of main rafters and raise this part of roof in position on ¼ pitch. Then place another pair of main rafters, one at each end coming down over front and back walls. Securely nail this section of roof, and set in place four 2x4 hip rafters. Then the rest of main rafters and jacks. A few pieces of roof sheathing should be nailed on rafters about in center so as to help keep in line.

Be sure that the rafters on which the sheathing is to break are placed exactly as shown on the blueprints. Be very careful to see that the ridge is kept level and that each rafter lines up. When all rafters have been erected and you find that one rafter does not line up with the rest, saw it off.

Paragraph 5

The covering of the roof is the next step in erection. The Roof Sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond with the Roof Sheathing details. When shingles have been furnished to cover roof, the sheathing has been supplied in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and space should cover 6 in. The sheathing, is so spaced in order that air can get underneath the wood shingles, and help in drying them out after they become soaked with heavy rains.

If the Roof Sheathing is laid tight and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather.

When semi-slate shingles, roofing, tin shingles, or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

On the blueprints you will find an isometric quarter full sized detail of eave of building, showing boxing-in of rafter ends. The material for boxing-in the eaves has all been marked "Eaves." Take this material and box in the

eaves as shown by details. Finishing, eight case, or small headed nails should be used for this purpose, so that the heads can be set into wood and puttied up. Then nail in place pieces of outside finish, door frames and two small window frames. Hang door and fit sash in frames.

The next step will be to place on the Roof Covering. Refer to roofing or shingling Par. of General Instructions. For painting instructions refer to Part III.

Instructions for the Erection of the Packard Garage 20x20

Paragraph 1

Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.

Fig. 2 shows construction of 4x4 sills supporting building.

Fig. 3 shows arrangement and construction of 2x4 studs in front wall.

Fig. 4 shows arrangement of siding and outside finish on Fig. 3.

Fig. 5 shows construction of 2x4 studding in back wall.

Fig. 6 shows arrangement of siding and outside finish over Fig. 5.

Fig. 7 shows construction of studding in left wall. Also construction of gable studding.

Fig. 8 shows arrangement of siding and outside finish over left wall.

Fig. 9 shows construction of studding in right wall and right wall gable studding.

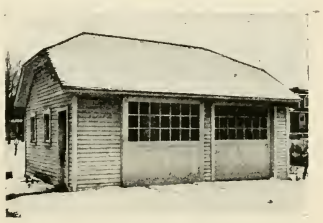
Fig. 10 shows arrangement of siding and outside finish over right wall.

Fig. 11 shows arrangement of rafters as they are placed over both sides of roof.

The four details show gable siding, roof sheathing, section thru eave of building and boxing in of end of rafters.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor, bolting the 4x4 sill to same. These 4x4 sills are shown at the bottom of Figs. 3, 5, 7 and 9 and by Fig. 2. If the building is to be erected on a cement floor, bolt the 4x4 shown at the bottom of Figs. 3, 5, 7 and 9 to the cement, and erect walls upon same, toe-nailing studs to sill. If the garage is to be erected on posts, the sills can be nailed up with wall and then spiked to posts, after the wall has been raised.



The Packard.

First refer to Fig. 3 and take 4x4. 20 ft., one 2x4 12 ft., and one 8 ft. long and mark off on them the distance showing the location of studs in this figure on blueprint. Then nail all the 2x4 studs 8 ft. 0 in. long in between them, nail in place the second set of 2x4's 12 ft. 0 in. and 7 ft. 4½ in. long. (Note this second set drops 3¾ in. from each end to allow intersection of 2x4's from front and back wall.) Now raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. In the same manner erect

Figs. 5, 7 and 9, carefully nailing them together at the corners and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place siding on studding before erecting rafters, as it will strengthen the walls. Two pieces of 2x6 20 ft. 0 in. long and mitered off at each end so they will not extend above rafters, have been furnished to tie side walls of building together. These have been marked "Collar Beams" or "Ceiling Joists." Nail them on at this time and be sure that they are placed so they will not interfere with rafters.

Next take siding and start putting it on from the bottom of the building, being very careful to drive each piece tight against the one below and securely nailing it so the joints will not open afterwards. Use the 5d common nails for the siding.

Paragraph 4

Then refer to Fig. 11 which shows construction of rafter plan of building. (Before erecting the rafters of building, it will be necessary to nail in place the square cut studs in the gables. Refer to Figs. 7 and 9, and nail in place the studs in the 6 ft. center section of these walls. Then nail in place the rafters which run from plate of front and back walls up to these studs.) Now space off on top plates of front and back walls the location of the seat of rafters, then take 2x4 piece marked "Ridge" and space off the location of rafters on both sides, and place at each end a pair of main rafters, and raise this part of roof in position on 1/3 pitch. Then place another pair of main rafters, one at each end coming down over gables studding of right and left walls. Securely nail this section of roof and then set in place four 2x4 hip rafters, and the rest of the main rafters and jacks. A few pieces of roof sheathing should be nailed on roof about in the center so as to help keep it in line. Be sure that the rafters on which the sheathing is to break, are placed exactly as shown on blueprints. Be very careful to see that the ridge is kept level and the ends of rafters lined up. When all the rafters have been erected, and you find that one does not line up with the rest, saw it off.

Paragraph 5

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond to the roof sheathing detail. When shingles have been furnished to cover roof, the sheathing has been supplied in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and a space should cover 6 in. The sheathing is so spaced in order to allow air to get underneath the wood shingles and help in drying them out after they have been soaked by heavy rains. If the roof sheathing is laid tight and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather.

When semi-slate shingles, roofing, tin shingles, or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 6

On the blueprints you will find an isometric, quarter full sized detail of eave of building showing boxing-in of rafter ends. The material for boxing-in the eave has all been marked "Eaves." Take this material and box in the eaves as shown by details. Finishing, eight case, or small headed nails should be used for this purpose, so that the heads can be set into wood and puttied up. Then nail in place pieces forming door frames and the two small window frames. Hang door and fit sash in frame.

The next step will be to place on the roof covering. Refer to roofing or shingling Par. of General Instructions.

Instructions for Erection of 30x20 Packard Garage

Paragraph 1

Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.

Fig. 2 shows construction of 4x4 sills supporting building.

Fig. 3 shows arrangement and construction of 2x4 studs on front wall.

Fig. 4 shows arrangement of siding and outside finish over Fig. 3.

Fig. 5 shows construction of 2x4 studding in back wall.

Fig. 6 shows arrangement of siding and outside finish over Fig. 5

Fig. 7 shows construction of studding in left wall, also construction of gable studding.

Fig. 8 shows arrangement of siding and outside finish over left wall.

Fig. 9 shows construction of studding in right wall and right wall gable studding.

Fig. 10 shows arrangement of siding and outside finish over right wall.

Fig. 11 shows arrangement of rafters as they are placed over both sides of roof.

The four details show gable siding, roof sheathing, section thru eave of building and boxing-in of end of rafters.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a foundation wall or cement floor, bolting the 4x4 sill to same. These 4x4 sills are shown at the bottom of Figs. 3, 5, 7 and 9 and by Fig. 2. If the building is to be erected on a cement floor, bolt the 4x4's shown at the bottom of Figs. 3, 5, 7 and 9 to the cement, and erect walls upon same, toe-nailing studs to sills. If the garage is to be erected on posts, the sills can be nailed up with wall and then spiked to posts, after the wall has been raised.

First refer to Fig. 3 and take 4x4 20 ft., 2x4 12 ft. and one 6 ft. long and mark off on them the distance showing the location of studs in this figure on blueprints. Then nail all the 2x4 studs 8 ft. long in between them, nail in place the second set of 2x4's 12 ft. and 5 ft. 4½ in. long. (Note this second set drops back 3¾ in. from each end to allow intersection of 2x4's from front and back wall.) Then raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. In the same manner erect Figs. 5, 7 and 9, carefully nailing them together at the corners and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place siding on studding before erecting rafters, as it will strengthen the walls. Four pieces of 2x6 20 ft. long and mitered off at each end so that they will not extend above rafters, have been furnished to tie side walls of building together. These have been marked "Collar Beams" or "Ceiling Joists." Nail them on at this time and be sure that they are placed so they will not interfere with rafters.

Next take siding and start putting it on from the bottom of the building, being very careful to drive each piece tight against the one below and securely nailing it so the joints will not open up afterwards. Use 5d common nails for the siding.

Paragraph 4

Before erecting the rafters of the building it will be necessary to nail in place the square cut studs of the gables. Refer to Figs. 7 and 9 and nail in place the studs in the 6 ft. center section of these walls. Then nail in place the rafters which run from plates of front and back walls up to the studs. Next refer to Fig. 11, which shows construction of rafter plan of building. First space off on top plates of front and back walls the location of the seat of rafters, then take 2x4 pieces marked "Ridge" and space off the location of rafters on both sides, and place at each end a pair of main rafters and raise this part of roof in position on 1/3 pitch. Then place another pair of main rafters, one at each end coming down over gable studding of right and left walls. Securely nail this section of roof, and set in place four 2x4 hip rafters, then the rest of the main rafters and jacks. A few pieces of roof sheathing should be nailed on rafters about in the center so as to help keep them in line. Be sure that the rafters on which the sheathing is to be nailed, are placed exactly as shown on blueprints. Be very careful to see that the ridge is kept level and the ends of rafters line up. When all the rafters have been erected, and you find that one does not line up with the rest, saw it off.

Paragraph 5

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond to the roof sheathing detail. When shingles have been supplied to cover roof, the sheathing has been furnished in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and a space should cover 6 in. The sheathing is so spaced in order to allow air to get underneath the wood shingles and help in drying them out after they have become soaked by heavy rains. If the roof sheathing is laid tight and wood shingles furnished, the space between the shingles and roof sheathing is very apt to become moldy in damp weather.

When semi-slate shingles, roofing, tin shingles, or slate are to be used as roof covering, the roof sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 6

On the blueprints you will find an isometric, quarter full sized detail of eave of building, showing boxing-in of rafter ends. The material for boxing-in the eave has all been marked "Eaves." Take this material and box in the

eaves as shown by details. Finishing, eight case, or small headed nails should be used for this purpose, so that the heads can be set into wood and puttied up. Then nail in place pieces forming door frames and the two small window frames. Hang door and fit sash in frame.

The next step will be to place on the roof covering. Refer to roofing and shingling Par. of General Instructions.

Instructions for the Erection of Peerless Garage 20x20

Paragraph 1

Explanation of different figures on blueprints

Fig. 1 shows floor plan of building.

Fig. 2 shows construction of 4x4 sills supporting building.

Fig. 3 shows arrangement and construction of 2x4 studs in right wall.

Fig. 4 shows arrangement of sheathing, outside finish over Fig. 3.

Fig. 5 shows construction of 2x4 studding in left wall.

Fig. 6 shows arrangement of sheathing, outside finish over Fig. 5.

Fig. 7 shows construction of studding rear wall, also construction of gable studding.

Fig. 8 shows arrangement of sheathing, outside finish over left wall.

Fig. 9 shows construction of studding in front wall and front wall gable studding.

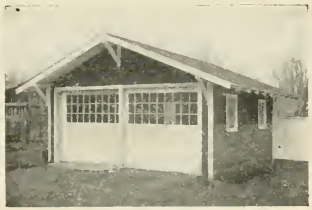
Fig. 10 shows arrangement of sheathing and outside finish over right wall.

Fig. 11 shows arrangement of rafters as they are placed over both sides of roof.

The four details show gable sheathing, brackets, section thru eave of building.

Paragraph 2

It is intended that this garage is to set on a foundation of posts, a concrete foundation or cement floor, bolting the 4x4 sills to same. These 4x4 sills are shown at the bottom of Figs. 3, 5, 7 and 9 and by Fig. 2. If the building is to be erected on a cement floor, bolt the 4x4's shown at the bottom of Figs. 3, 5, 7 and 9 to the cement, and erect walls upon same, toe-nailing studs to sills. If the garage is to be erected on posts, the sills can be nailed up with wall, and then spiked to posts, after the wall has been raised.



The Peerless

First refer to Fig. 3 and take 4x4 20 ft., one 2x4 12 ft. and one 8 ft. and mark off on them the distance showing the location of studs in this figure on blueprints. Then nail all the 2x4 studs 8 ft. 0 in. long between them, nail in place the second set of 2x4's 12 ft. 0 in. and 7 ft. 4½ in. long. (Note this second set drops 3¾ in. from each end to allow for intersection of 2x4's from front to back wall.) Now raise this wall in position on foundation posts and hold in place with temporary supports until remaining walls have been erected. In the same manner erect Figs. 5, 7 and 9, carefully nailing them together at the corners and see that they are perfectly square and level with each other.

Paragraph 3

It is a good plan to place sheathing on studding before erecting rafters, as it will strengthen the walls. Two pieces 2x8 20 ft. 0 in. long and mitered off at each end so they will not extend above rafters have been furnished to tie side walls of building together. These have been marked "Collar Beams" or "Ceiling Joists." Nail them on at this time and be sure that they are placed so they will not interfere with rafters.

Next take sheathing and start putting it on from the bottom of the building, being very careful to drive each piece against the one below and securely nailing it. Use the 8d common nails for the sheathing.

Paragraph 4

Then refer to Fig. 11, which shows construction of rafter plan of building. First space off on top plates of right and left walls the location of the seat of rafters. Then take 1x4 in. pieces marked "Ridge" and space off the location on both sides, and place at each end a pair of rafters and raise this part of roof in position on ¼ pitch. Securely nail this section of roof and then set in place the rest of the rafters. A few pieces of roof sheathing should be nailed on rafters about in center so as to help keep them in line. Be sure that the rafters on which the sheathing is to break are placed exactly as shown on blueprints. Be very careful to see that the ridge is kept level and the ends of rafters line up. When all the rafters have been erected, and you find that one does not line up with the rest, saw it off.

Paragraph 5

The next step will be to place the mitered studs in the gable of the building. Place the center stud first and then nail all the rest in pairs. You will find all the mitered studs marked "Gable Studding Fig. 7" and "Gable Studding Fig. 9." Then take the sheathing marked "Gable Fig. 8" and "Gable Fig. 10" and sheathe up the gables.

The covering of the roof is the next step in erection. The roof sheathing has all been marked "Roof Sheathing" and has been furnished in lengths to correspond with those shown on blueprints. When shingles have been furnished to cover the roof, the sheathing has been supplied in 1x4 in. widths and is to be placed over the rafters, laying it 2 in. apart, that is, a piece of sheathing and a space should cover 6 in. The sheathing is so placed in order to allow air to get underneath the wood shingles, and help in drying them out after a heavy rain, and they have become soaked with water. If the roof sheathing is laid tight and the wood shingles furnished, the space between the shingles and the roof sheathing is very apt to become moldy in damp weather.

When semi-slate shingles, roofing, tin shingles or slate are to be used as roof covering the roof, sheathing is usually furnished in 1x6 in. widths and is to be laid tight together over the rafters.

Paragraph 6

On the blueprints you will find an isometric, quarter full sized detail of eave of building showing rafter ends. Nail in place pieces forming door frames and the window frames. Hang the door and put sash in frames.

The next step will be to place on the roof covering. Refer to roofing and shingling Par. in General Instructions.

Instructions for the Erection of Aladdin Summer Cottages

ALADDIN summer cottages are constructed in the same manner as the Standard Homes with the exception that, first, they are furnished to be erected on post foundations; second, no sub-flooring is furnished; third, no wall sheathing is furnished; fourth, novelty tongued and grooved siding is used instead of bevel siding; fifth, no interior wall covering or trim is furnished and partitions are constructed out of matched ceiling.

In erecting summer cottages, first read over carefully the instructions in Part III, the paragraph on "Unloading and Caring for Material" and "Special Notes Regarding Blueprints."

Use the following steps for the erection of the different cottages:

1st Erect post foundation.

2nd Lay sills.

3rd Lay joists over sills.

4th Lay finish flooring (refer to paragraph on flooring in Part III.)

5th Erect frame of outside walls.

6th Erect porch joists (refer to paragraph on porch joists in part III).

7th Lay porch flooring.

8th Nail on siding of outside walls. The siding furnished with summer cottages is novelty tongued and grooved standard pattern Nos. 105, 106 or 115. This is to be applied directly to the studs of the outside walls. Each piece should be driven tightly into the preceding one and nailed with 5d nails. Drive the nails in just above the tongue and groove and at an angle of about 15 degrees; this will assist in drawing the joints together. Each joint of all the courses should break on a stud and the ends of the pieces squared to make a good joint.

9th Nail in place the braces furnished to be placed on top of the walls supporting the rafters, which are for the purpose of holding the walls together, and taking up some of the strain caused by the span of the roof.

10th Erect the roof rafters (refer to different style roofs in Part III).

11th Erect gable studs and siding.

12th Lay roof sheathing (see roof sheathing paragraph).

13th Nail on outside finish. The outside finish of summer cottages is placed over the siding. (See paragraph on outside finish.)

14th Apply roof covering (see paragraph on shingling and roofing materials).

15th Erect porch roof. If main roof does not cover porch, refer to the different styles of porch roofs for instructions.

16th Nail together outside window and door frames, hang sash and doors. The window and door frames furnished with summer cottages are the same as those for Standard Buildings, but are furnished without trim.

17th Erect interior matched ceiling partitions. By carefully studying blueprints you will find that the summer cottage partitions are constructed of matched ceiling, held in place at the floor by pieces of ¼ round molding and capped with a grooved partition cap. Be careful to see that joints of each piece are closely drawn up and securely nailed. The same care should be exercised in placing and squaring up the partitions of summer cottages as with those of frame construction.

18th Painting (refer to paragraph on painting in Part III).

Barns

Introduction

BETTER farm methods require better buildings, not necessarily expensive ones, but buildings that are well planned and properly adapted to the work for which they are intended. A farm building should be first a property saver, second a labor saver. Farm buildings may be considered in a sense as a necessary expense, but they should also be considered in the light of an investment.

Aladdin barns are furnished in many sizes from 16x24 up to 30x100, both with gambrel and gable roof construction. To the purchaser of each barn is sent a complete set of blueprints illustrating in detail the construction and location of all the different kinds of material.

General specifications of material furnished for Aladdin barns:
Sills, 6x8.
Studding outside walls and gables, 2x6.
Rafters, 2x6.
Collar beams and braces, 2x6.
Cross braces outside walls, 2x6.
Anchor braces, 2x6.
Top wall plates, double, 2x6.
First floor joists, 2x12.
Flooring first floor, 2 in. planks.
Second floor joists, 2x8 and 2x10.
Flooring second floor, 1 in. lumber.
Stall studding, 2x4.
Stall siding, 1 in. lumber dressed.
Mangers and stalls, 1 in. lumber dressed.
Roof sheathing, 1x4 and 1x6 in. dressed.
Roof covering, red cedar shingles or roofing.
Siding, perpendicular 1x10 in. barn boards with battens or novelty tongued and grooved standard patterns.
Windows, 18x24, glass measurement.
Doors, batten in pairs and single.
All hardware.

In quoting prices on Aladdin barns, the material for first and second floors and mangers are listed as extras, as many people prefer to erect their barns with cement first floor, and patent stall equipment, and the variety of uses to which a barn is put, makes it possible to use or not use a second floor.

Before starting the erection of your barn, first carefully read over the instructions on "Unloading and Caring for Material" and "Special Notes Regarding Blueprints" in Part III.

Barn Foundations and Sanitary Floors

Pier Foundations: All Aladdin barns are constructed with 6x8 in. sills so they can be erected on posts, piers or solid foundation walls as desired. If you intend to erect your barn on a pier foundation, use the following instructions: First, clean up building site and stake out location of piers; we will

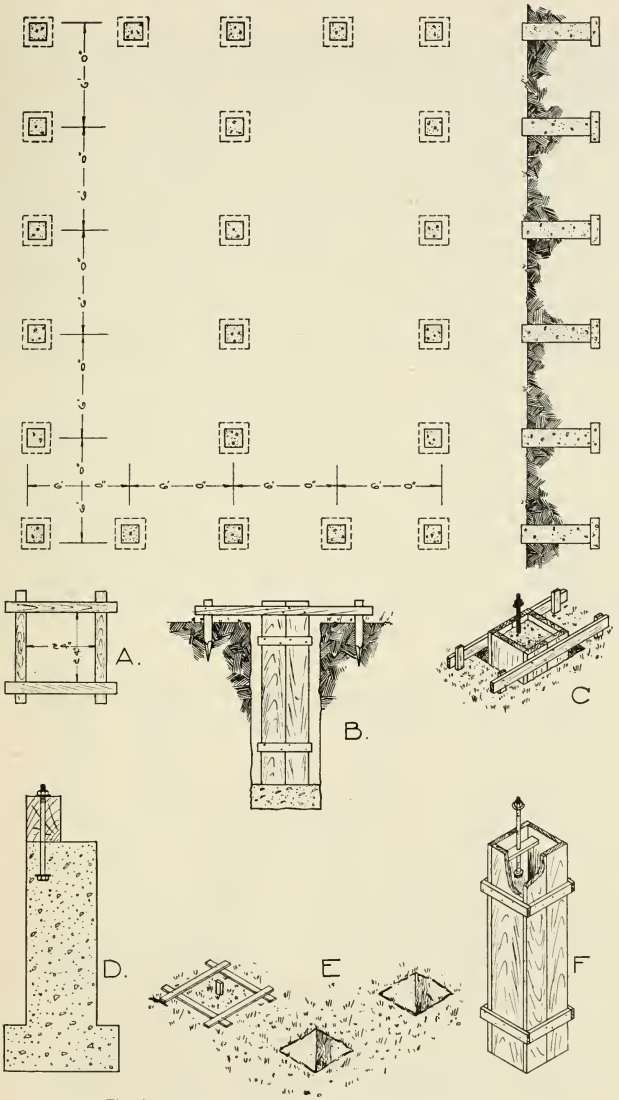


Fig. 249—Details of construction for barn pier foundation.

use for example a barn 24 ft. wide and 30 ft. long. A barn of this size will require piers placed on 6 ft. centers and should be 12 in. x 12 in. square. Square up site 24x30 in size, using the methods described in paragraph "Laying Out Building Lines" of Part I. Then drive in stakes, showing location of piers. Carefully study details shown by Fig. 249.

If you construct your piers 12 in. x 12 in. in size, the footings should be about 6 in. longer each way, that is, 24 in. x 24 in. square and from 8 in. to 10 in. deep. It is a good plan to construct a templet 24 in. x 24 in. square as shown in Fig. 249 to use in digging pier trenches. Place the templet so the stake indicating the middle of the pier will come in the center of it, then mark the size of the excavation with spade, remove templet and complete trench.

The footings should be placed below the frost line of your community. No forms will be necessary for footings, as the banks of the trenches will hold them in place. Stretch a chalk line in position over the row of pier trenches and use measuring pole to be sure that excavations are the same depth. Then drive a stake in the bottom of the trench, letting it extend up 8 in. or 10 in., the desired thickness of the footing, and pour in concrete until it is flush with the top.

Next construct some 12 in. x 12 in. wood pier forms and set them in place, holding them plumb by driving in 2x4 stakes and nailing on cross braces. It would be almost impossible to set these forms so the tops would all come level. Therefore, it is a good plan to construct them a little higher than necessary and drive in nails to indicate the top level. Construct the pier forms as shown by detail in Fig. 249—note that a small piece of 1 in. material can be nailed in place across the center of the form into which is bored a hole to support dowel in position while concrete is being poured. The dowels or bolts should be held perfectly straight because, it would be difficult to bore hole in sill at an angle. If you tried to straighten them up after concrete is set, the piers are apt to be cracked.

The cost and amount of material required can be worked out from instructions given in Part I.

If no first floor is to be used, the piers shown in the center of Fig. 249 will not be necessary as there will not be a center sill.

Concrete Foundations

The same care should be exercised in the construction of foundations for barns as for dwelling houses, that is, the walls and footings should be of the proper size and materials used of the best grades.

First the building must be properly laid out and excavations made for walls. The footings should be carried down below frost line of ground so they will not be damaged by the cracking and settling of the soil.

Refer to Fig. 250 which shows foundation plan of a 24x30 ft. barn, together with cross section of walls, floor and construction details. The walls of any ordinary barn should be 10 or 12 in. thick and the footings about 12 in. wider than the walls and from 10 to 12 in. thick, depending upon the bearing power of the soil.

First, erect batten boards at the corners of your building site as shown by detail "C" of Fig. 250 and stretch in place chalk lines to give the exact outside dimensions for walls. If you are to use a 12 in. wall, dig a 24 in. trench around your building down below frost line or to

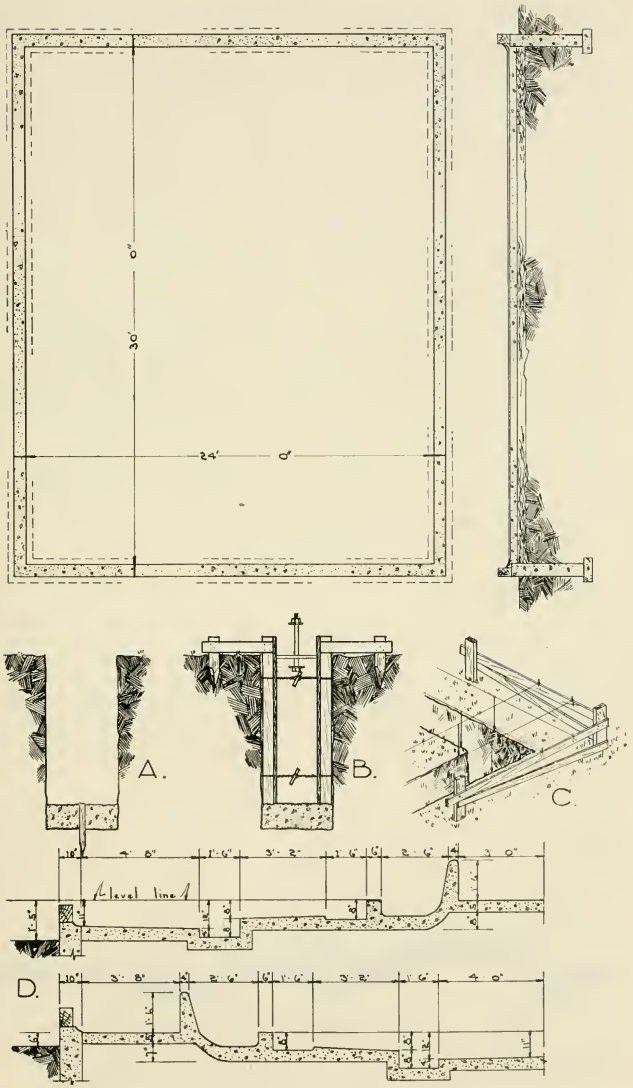


Fig. 250—Details of construction for barn wall foundation.

sub-soil. In the bottom of the trench, drive some small stakes to gauge the thickness of the footings. The stakes should be driven in the ground so they will project up 10 in., or the thickness of footings you plan on using. The tops of the stakes should all be on a level, in which case they will act as a guide to give even footings to start the walls upon.

Detail "B" of Fig. 250 shows method of erecting forms for concrete walls.

Matched lumber, if it can be obtained, is the best to use for forms, as this will prevent the water from carrying off any of the strength out thru the cracks, which would be between the boards if the forms were constructed of ordinary sheathing. Do not have the 2x4's which hold the forms in place, too far apart, as this will cause the boards in between to give away to some extent and make an uneven wall. If good sheathing is used for forms, they should be placed about 18 or 20 in. apart.

Tie the 2x4's together with good strong fence wire. If you wish a 12 in. wall, cut a lot of small pieces of wood about 1x2 in. and 12 in. long and place them in between the sheathing of the inside and outside forms, drawing the forms tightly together by the use of the form ties or pieces of wire placed around the 2x4's of the forms and drawn together by twisting them in the center. The small pieces of wood should be removed with a rake as the concrete is poured into the forms.

Dowels should be placed in the walls to tie the sills down. To do this, a small piece of 1x3 in. material 12 in. long can be nailed in place between the two sides of the forms and the bolts held in place by boring a hole in this piece to admit bolt. The bolts should be set in the wall plumb because it will be difficult to bore holes in sills on an angle.

Carefully read over the instructions in Part I, on mixing concrete, materials necessary, etc.

Sanitary Floors

The floor material in Aladdin barns is quoted as an extra, because concrete floors are in general use thruout the country and are much more sanitary and serviceable than a wood floor, when barn is used to house cattle. The cost is so small and the cash returns are so great that the floors soon pay

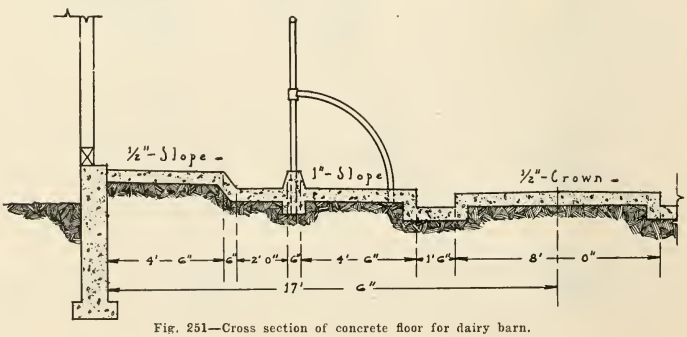


Fig. 251—Cross section of concrete floor for dairy barn.

for themselves in preventing the breeding of flies, in the saving of liquid manure, in the reduction of labor, and in the healthier condition of the stock.

Detail "D" of Fig. 250 shows cross sections of construction of concrete floors for cow stalls. Fig. 251 also shows sections of construction of dairy barns with usual dimensions. The following instructions can be modified to suit conditions.

For average conditions lay out the stalls on 3 ft. 6 in. centers, 4 ft. 6 in. in length and 6 in. from manger wall to drop-gutter. The manger is 2 ft. 6 in. wide at the top and 2 ft. at the bottom, with one face sloping up to the feed-alley floor. The depth is 7 in., measured from the stanchion setting, and 8 in. from the alley floor. The feed alley is 4 ft. 6 in. wide. The drop-gutter has a width of 18 in. It is 8 in. deep gauged from the stall floor, which is 2 in. higher than the 8 ft. driveway. For establishing grade lines a carpenter's spirit level (or a water level) and a chalk line are very helpful.

To prevent possibility of the floor settling, remove all manure before grading the surface of the earthen floor. Carefully tamp back the dirt around water pipes and the drains which carry waste water and liquid manure to the water-tight concrete manure pit. Do all filling as long as possible before building the concrete floor. As a foundation for the stall floors proper, place a 6 in. thickness of coarse broken stone or screened gravel to keep the floor from direct contact with the ground. Since the stall floors are of prime importance, it is well to make them first. During this operation the unpaved driveway and alleys can be used as working space. Then finish, in order named, the feed alleys, the driveways, the mangers, and lastly the gutters.

Mixing and Laying the Concrete

For the plan given, 5 ft. 6 in. from the center line of the driveway stake on edge (and to line and grade) a 2x12 in. plank to serve as a form for the stall floor at the gutter. Likewise set a similar board, 5 ft. distant, to mold the 6 in. manger wall and stanchion setting. Bear in mind that the stall floor has a slope of 1 in. toward the gutter and that the stanchion setting rises 7 in. above the stall floor. Drainage for gutters and mangers will be provided by sloping their concrete bottoms.

Proportion the concrete 1 bag of Portland cement to 2½ cubic feet of sand and 5 cubic feet of crushed rock, or 1 bag of cement to 5 cubic feet of clean pit gravel. At one operation lay the full 5 inch thickness of the stall floor and finish three stalls the same as one section of sidewalk. No surfacing mortar is needed. For setting patented stall divisions, follow the manufacturer's directions; for home-made divisions, make mortises by tamping the concrete around greased tapering wooden cores, which are withdrawn as soon as the concrete stiffens. A wooden float is best for finishing the floor. A steel trowel yields a surface entirely too smooth, and such a finish should always be roughened by brushing with a stable broom.

While the concrete of the three stalls is still soft, mold the stanchion setting (6 in. thick) upon it. As forms use the projecting 7 in. height of the 2x12 piece already in place and two 1x6 in. boards toe-nailed together so as to provide another 7 in. height and a bearing plate to rest on the green concrete. These forms may be made dish-shaped for swinging stanchions. Fill the forms with mushy wet concrete, trowel the surface, round the corners, and set the stanchion holders. Repeat the operation until all stall floors are

completed. The feed alleys and driveway are easily built; they are merely rough-finished sidewalks. Place the waste-water outlets in the mangers at intervals of 28 ft. and give the bottom a slope of 1 in. toward each outlet for a distance of 14 ft. on each side of it. The drop gutters may be drained in like manner or can be sloped slightly in one direction for their full length. For ease in cleaning, round all angles and corners (except at the bottom of the drop gutters) by applying a 1 to 2 cement-sand mortar immediately after removing the forms.

Caring for Cattle and Floor

Regardless of the kind of floor, bedding of straw or litter is an absolute necessity; it keeps the cow clean and absorbs the valuable liquid manure. If the help cannot be depended on to bed the cows properly, it is advisable to use a removable wooden grating or platform. Cork bricks also give satisfactory results, but are somewhat expensive. They are set in a 2 in. depression in the floor and are held in position on all sides by the concrete acting as a curb.

With the proportions and thicknesses given above, 4 bags (1 barrel) of cement, 10 cubic feet of sand (say ⅜ cubic yard), and 20 cubic feet of crushed rock (about ¾ cubic yard) will lay 45 to 50 square feet of floor.

Sills

All Aladdin barns are furnished with 6x8 in. sills to support the frame of the barn. It is intended that they extend around all sides of barn and are to be fastened to the piers or wall foundation by placing bolts or dowels in the piers or walls during construction. Bore holes in the sills the same diameter as the bolts, and securely fasten them when set in place. The sills are furnished with the corners notched out, so one sill will intersect with the other. See Fig. 252.

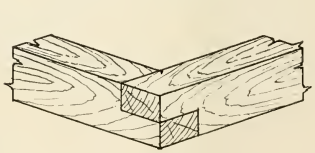


Fig. 252—Intersection of sills at corner of building.

6x8 in. sills over 16 ft. in length have to be spliced together in order to make the required length, and you will find that the different pieces have been numbered to indicate the manner in which they are to go together. For example: a 60 ft. sill might be furnished in 5 or 6 lengths; the pieces will be marked as follows in the order they are to be laid—"60 ft. sill No. 1," "60 ft. sill No. 2," etc.

If the building is furnished with wood first floor joists and flooring, you will find that sills have been furnished to go thru the center of building to support the break in joists. If no first floor is purchased the outside wall sills are the only ones furnished.

After the sills have been laid and securely fastened, be sure that they are perfectly level and square; this is absolutely necessary in order to have the material work out and fit as intended.

First Floor

As stated before the prices on barns are quoted with the first floor joists and flooring as an extra. If they have been furnished they should be erected as the next step. The first floor joists are 2x12 and are spaced on two foot centers; use square and space locations on sills, then set joists and securely nail them in place. The flooring for the first floor is 2 in. material and usually in 8 in. widths. The lengths furnished are shown on joist plan. Nail this flooring over the joists, alternating the different lengths as shown on blueprints. 16d nails are to be used for first joists and flooring.

Erecting Frames of Outside Walls

First carefully study Fig. 253. Detail "A" of Fig. 253 shows section of wall showing construction. When floor joists are not furnished, the studs of side walls are erected upon the wall sills. Detail "B" of Fig. 253 shows construction of wall when first floor joists and flooring are furnished. The walls are erected upon the flooring of first floor.

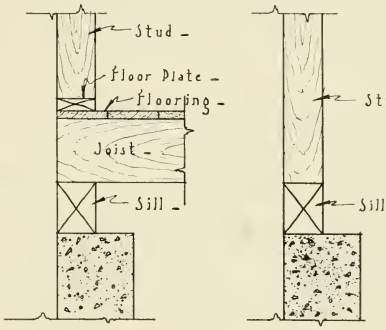


Fig. 253.

To erect wall on top of sills, use steel square and mark off on top of sills the different locations of the wall studs, and then space off the same distances on the first set of wall plates. Nail wall plates on top of studs while they are laying on the ground and then raise wall into position, toe-nailing the lower ends of the studs to the sills. The wall frames should be squared up and held in place with temporary supports until all walls have been erected. See method of supporting walls in Part III.

To erect walls on top of floor: Carefully study blueprints and note that the walls are constructed to interlock at the corners. The walls consist of floor plates or the plates which are nailed to the floor of building, upright studs and two sets of top wall plates. If the building is furnished with perpendicular barn boards, short studs are furnished to go between the upright studs to give more bearings to wall covering. The longest walls of the building, or the walls which run the same way as the flooring, should be erected first. In this manner time can be saved, as one man can be laying out the walls as soon as a few feet of flooring has been laid across the joists.

To lay out the walls, first lay the floor plates on top of the floor of building and lay one set of wall plates along side of them. Now space off with a steel square, the location of the upright studs of the walls and also the door openings. Then lay these plates on the floor of building and nail the upright studs between them; then put in place the window and door headers,

cap wall with second set of plates, raise into position and spike to the floor of building. Square and plumb the wall frame and nail in place sufficient temporary supports until the remaining walls have been erected. All the walls should be erected in the same manner, and the corners where the walls intersect should be carefully spiked together, 16d nails have been furnished for frames.

Second Floor Joists and Flooring

In our standard barns, the second floor joists extend over one end only, generally a 12 ft. section. If a full second floor is required the material is quoted as an extra charge.

It is a good plan to erect the second floor joists at this time, as it will strengthen the outside walls. In gambrel roof barns the second floor joists set on top of the outside walls and in gable roof construction they are supported by joist hangers nailed on the inside of the wall studs. First pick out the material marked "Girder" and "Girder Supports" and erect in place as shown by location on blue prints. The lower ends of the girder supports should be set on a solid foundation of concrete, brick, or supported by a mud sill.

If your barn is gambrel construction, mark off the location of the second floor joists on top of the girder and top plates of outside walls, and securely nail them in place. If your barn is gable construction mark off location of joists on top of girder and on top of joist hangers and nail the joists in place. The ends of the joists that rest on joist hanger should also be spiked to the sides of the upright studs of the side walls with which they intersect.

The flooring for the second floor is 1 in. and has all been marked "Second Floor Flooring" and the correct lengths furnished shown on second floor joist plan of blueprints. Nail this flooring in place on second floor joists, alternating the lengths.

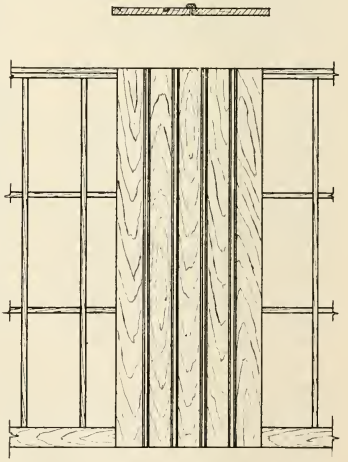


Fig. 254—Method of placing 2x6 braces between studding of walls.

Siding

Aladdin barns are furnished with horizontal tongued and grooved siding or perpendicular barn boards and battens. It is intended that these wall coverings be nailed directly to the frame of the side walls.

If novelty siding is specified, one of the standard patterns shown by Fig. 208 is furnished. On the blue prints, the different lengths to be used are shown the way they are to be nailed over the frame alternating the

lengths. In nailing on this siding, use 5d nails and be very careful that each piece is nailed tightly down against the preceding one, so the joints will not open up. All siding should be carefully butted and for best work the ends should be dipped in white lead and oil and should always lap over a stud. This will give a good bearing for the end nailing. It will require about 15 lbs. 5d nails to lay 1,000 ft. of novelty siding. The nails should be placed just above the joint of the tongue, and nailed carefully with the nails directed almost straight in. Pound your nail heads up to siding and then use nail set. Do not have three or four hammer dents around each nail head.

If the outside wall covering of the building is perpendicular barn boards and battens, short studs have been supplied to be nailed between the studs so each piece will have a bearing about every 2½ or 3 ft. The barn boards have been furnished to extend full height of the walls in lengths as shown on blue prints. The joints between the boards are to be covered with battens as shown by Fig. 254. Securely nail each board with at least two nails on all bearings, and place battens so they will be centered over the joint.

Roofs

Two styles of roof construction are furnished on Aladdin barns, gable and gambrel. Carefully study Fig. 255, which shows construction details of gable roof barns.

The rafter plan on the blueprints will show the arrangements of the rafters over the walls of the building and the correct distances that they are to be placed apart. It also shows the ridge which is to go between the rafters at the top. The different lengths of roof sheathing are shown laid across the top of the rafters with lengths alternated.

To erect the roof, first place sufficient planks to enable a couple of men to move around with horses of sufficient height to allow them to reach up to ridge. Then take the pieces of material the correct length shown on blue prints, for ridge pole, and measure off on them the same distance marked off on the top plates of the outside walls, or where the heel of the rafters is to set. Then start at one end of building and commence nailing the rafters on both sides of the roof. Be very careful to see that the ridge is kept perfectly level and in line. A chalk line should be placed on the end of the rafters, and if when all rafters have been erected, you find that one does not line up, trim it off. A few pieces of roof sheathing should be nailed on the rafters as they are being erected, so as to help keep them in line and to be sure that the ones on which the sheathing is to break, are placed exactly as indicated by dimension lines of blueprints. The rafters have all been cut on a patent rafter machine making them uniform in length and the miter exact.

If the walls of the building are out of plumb, it will affect the rafters and ridge and sometimes this makes it necessary to lower one rafter and raise the one opposite it in order to bring the ridge in line.

It is a good plan to find the center of the two gable walls and raise a temporary stud at each end of building, and stretch a chalk line with plumb

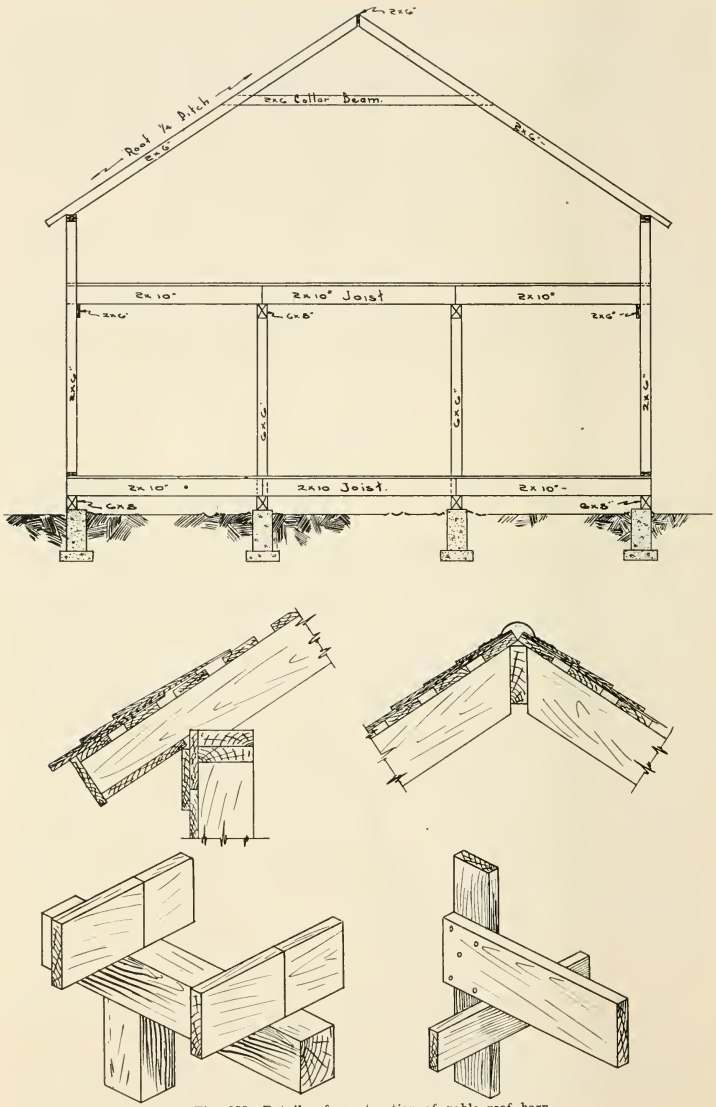


Fig. 255—Details of construction of gable roof barn.

bob, then bring the center of the ridge in line with bob. Pieces can also be nailed on walls below the two gable ends so that the first and last pair of rafters will be plumb with the framing of the side walls.

Fig. 256 shows construction details of a gambrel roof barn. The construction varies in this style building according to the width and span of the roof. Roofs constructed in this manner have to be well braced and tied together. Detail "A" of Fig. 256 shows the bracing of a roof when full second floor is used and detail "B" shows bracing when the second floor is furnished in one end section only. The building in this case, especially if it has a large span should have the top rafters collared together; the top rafters should be securely tied to the lower rafters and the lower section of rafters tied to the side walls. To erect this style roof, first refer to blueprint showing construction of the studs in gables of building and raise them into position. This will give you supports for the first set of rafters which run from the top of the side walls up to the break in the roof. Then take the pieces of 2 inch material shown forming ridge of building, and mark off on these pieces the correct distances that the rafters are to be spaced. Also mark off the spacing on the top plates of the side walls of the building. The rafters of the gable which go from break in roof up to ridge can be erected now and one end of the ridge should be placed between them; the other end will have to be supported by temporary supports until the balance of the rafters are erected.

All the remaining rafters will have to be erected in pairs, that is, the upper and lower rafters should be nailed together with braces and then raised into position against ridge and the collar beams nailed between them. A few strips of roof sheathing should be nailed in place over the rafters as soon as they are raised to help support, and also keep them the correct distance apart. Have a chalk line suspended from ridge to keep it in line with center of building. A large detail section of building is shown on blue prints, giving the location, size and length of all the braces on the rafters. Nail them in place accordingly.

Gable Studding and Siding

In gable and gambrel roofs, there are a certain number of mitered studs in the gables of the building. These mitered studs you will find tied together and marked "Gable Studding," and the lengths marked upon them, corresponding to the lengths shown on blue prints. In nailing the gable studs in place, always start in the center of the wall and work down toward the end of rafters. This will prevent you from driving them in place too tight and springing rafters out of line.

You will also find that the gable siding or perpendicular barn boards have been mitered, bundled together and marked for the gable to which they belong, the pieces are also marked with a length and a number to correspond to the number shown on pieces in detail of gable. You may find three pieces marked No. 1 and by referring to detail of gable siding, you will notice that these pieces when properly placed will go across your building, and the joints will break on gable studding. The next set of pieces will be marked No. 2, and so on up the gable. Do not let any pieces of siding extend above the rafters, as this will raise the roof material out of line.

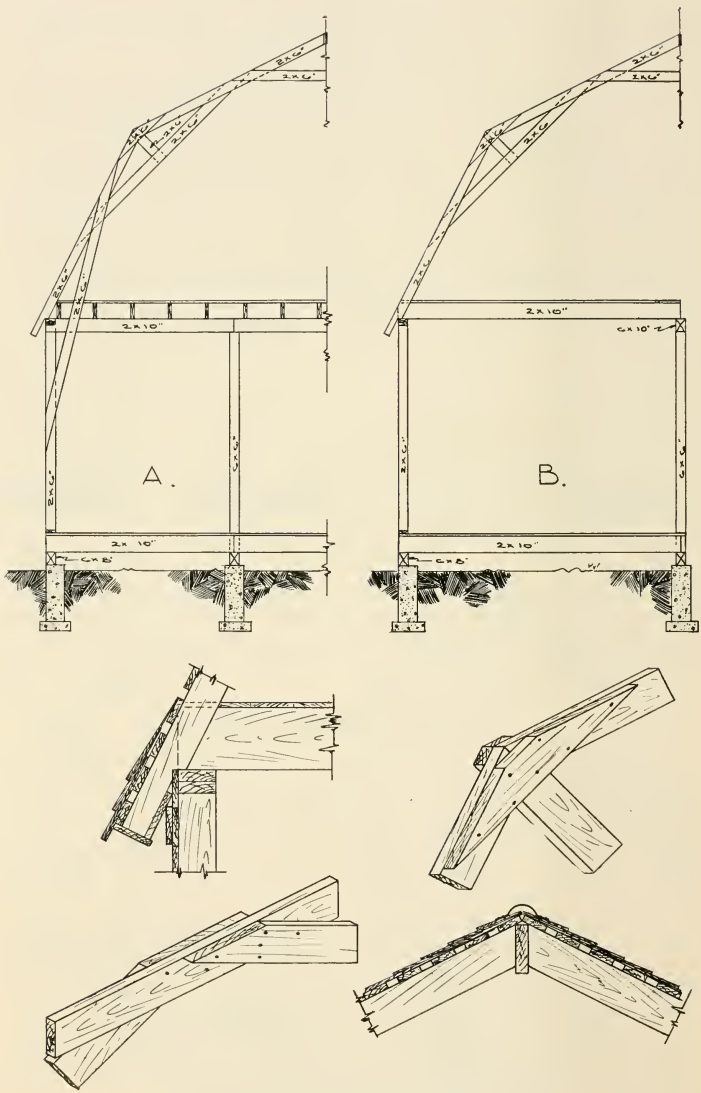


Fig. 256—Details of construction for gambrel roof barn.

Roof Sheathing

See paragraph on Roof Sheathing in Part III.

Eaves and Outside Finish

See paragraphs in Part III, also study details shown by Figs. 255 and 256.

Roofing and Shingling

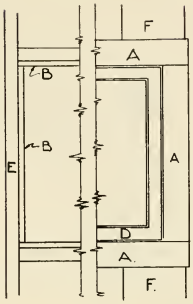
See paragraph in Part III.

Painting

See painting paragraphs in Part III.

Window and Door Frames

Fig. 257 shows construction of a barn window frame. These frames are constructed of 1 in. material in lengths shown on blueprints and are bundled together and marked "Window Frames." The material for doors and door frames has been bundled together and marked accordingly.



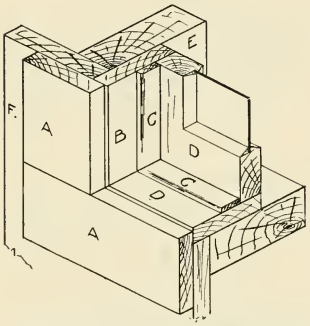
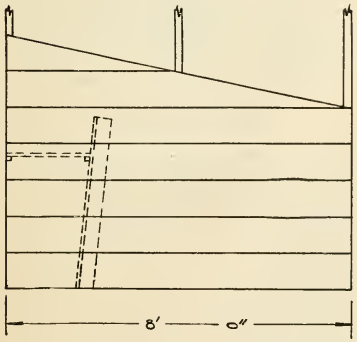


Fig. 257—Details of barn window frame.



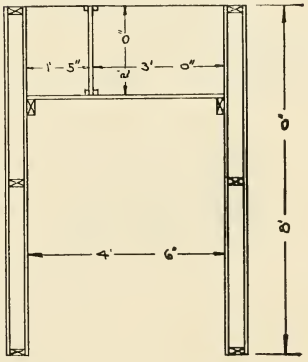


Fig. 258—Details of barn stall.

Weights and Measures

Measure of Angles or Arcs:

60 seconds equals 1 minute
60 minutes equals 1 degree
90 deg. equals 1 rt. angle or quadrant
300 degrees equals 1 circle

Avoirdupois Weight:

437.5 grains equals 1 ounce
16 ounces equals 1 pound
100 pounds equals 1 hundredweight
20 cwt. or 2,000 lbs. equals 1 ton

Long Ton Table:

16 oz. equals 1 pound
112 pounds equals 1 hundredweight
20 cwt. or 2,240 lbs. equals 1 ton

Troy Weight:

24 grains equals 1 pennyweight
20 pennyweights equals 1 ounce
12 ounces equals 1 pound

Dry Measure:

2 pints equals 1 quart
8 quarts equals 1 peck
4 pecks equals 1 bushel

Liquid Measure:

4 gills equals 1 pint
2 pints equals 1 quart
4 quarts equals 1 gallon
31½ gallons equals 1 barrel
2 barrels equals 1 hogshead

Linear Measure:

12 in. equals 1 foot
3 ft. equals 1 yard
5.5 yards equals 1 rod
40 rods equals 1 furlong
8 furlongs equals 1 mile

Square Measure:

144 sq. in. equals 1 sq. ft.
9 sq. ft. equals 1 sq. yd.
30¼ sq. yds. equals 1 sq. rod
160 sq. rods equals 1 acre
640 acres equals 1 sq. mile

Surveyor's Measure:

7.92 inches equals 1 link
25 links equals 1 rod
4 rods equals 1 chain
100 links equals 1 chain
60 ft. equals 1 chain
80 chains equals 1 mile

Surveyor's Square Measure:

625 sq. links equals 1 sq. rod
16 sq. rods equals 1 sq. chain
10 sq. chains equals 1 acre
640 acres equals 1 sq. mile
36 sq. miles equals 1 township

Cubic Measure:

1728 cu. inches equals 1 cu. foot
27 cu. feet equals 1 cu. yard
128 cu. feet equals 1 cord
24¾ cu. feet equals 1 perch

Miscellaneous Weights

Material	Wgt. in Lbs. per Cu. Ft.
Bbl. Lime	50
Bbl. Cement Plaster	73
Box Tin	278
Box Glass	60
Paving Brick	150
Common Building Brick	120
Soft Building Brick	100
Granite	170
Marble	170
Limestone	160
Sandstone	145
Slag	40
Gravel	120
Slate	175
Sand, Clay and Earth (dry)	100
Sand, Clay and Earth (wet)	120
Mortar	100
Stone Concrete	130 to 150
Paving, Asphaltum	100
Plaster of Paris	140
Glass	160
Spruce	25
Hemlock	25
White Pine	25
Douglas Fir	30
Yellow Pine	40
White Oak	50
Common Brick Work	100 to 120
Rubble Masonry	130 to 150
Ashlar Masonry	140 to 160
Cast Iron	450
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After-word

E will be glad to receive any articles from our builders, on any subject which they think would have been a help to them, had it been contained in this book; any unforeseen cost which we can publish to guard our builders so that they can get value received for every dollar spent in the erection of their homes; any suggestion or error, typographical or otherwise, in order that they may be corrected before the next edition goes to the press.

We desire to thank all those who sent us suggestions and criticisms for this edition.

The Aladdin Company

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NUMBER 5205

Aladdin Service Department

Bay City, Michigan.

Consulting Certificate

This Certifies that Wm. E. F. Ores

is entitled to the privileges of the Service Department of the Aladdin Company for One Year.

The Service Department is composed of a large corps of practical engineers and experts. Each inquiry is referred to the person most familiar with the subject; and the solution, explanation or reference to best authorities is forwarded to the inquirer.

The above named is entitled to refer to the Service Department all problems connected with the building of his home. The Holder is further entitled to the benefit of the Aladdin Company Cooperative Department.

This Certificate is not transferable, and the Holder agrees to use the privileges hereby conferred solely for his own benefit.

The Number of this Certificate must be mentioned in all communications.

ALADDIN HOMES Sold On The GOLDEN RULE

W. J. Sovereign President